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ORIGINAL ARTICLES.

SOME ASPECTS OF THE STUDY OF HEREDITARY EYE DEFECTS.

By C. H. Danforth, Ph.D.,
ST. LOUIS, MO.

From the Department of Anatomy, Washington University Medical School.

The eye has furnished one of the most fertile fields for the study of human heredity. No better illustration for the unit factor hypothesis is to be found than that afforded by the heredity of pigmentation in the normal iris. Likewise in the transmission of abnormalities, both structural and functional, the eye offers many striking examples, and in consequence of this fact some of the most important papers relating to the heredity of abnormal conditions have been written by ophthalmologists.

For the student of heredity the chief interest in eye defects has been, in the past, to learn whether or not the general laws that have been derived from the results of controlled breeding of lower animals apply with equal force to the human being. In general, as is well known, there has been found to be a rather striking similarity between the mode of inheritance in man and the lower animals. It may not be out of place to review briefly a few points of importance in this connection.

Cytological evidence has furnished a strong presumption in favor of the idea that the truly heritable characteristics of an animal owe their existence to some peculiarity in the chromatin of the germ cells, and this view is still further strengthened by the results of immense numbers of breeding experiments. In the case of the fruit fly (Drosophila ampelophila), Morgan and his collaborators[1] in what is probably the most elaborate series of experiments of this sort that have ever been undertaken, are

able to refer the determiners for certain eye peculiarities, not merely to certain chromasomes, but actually to definite loci within the chromosomes. The method of analysis in this case is comparable to that employed by the physico-chemist in determining the constitution of molecules, and the conclusions likewise may be tested in an analogous manner.

The results of these studies on Drosophila and of many other investigations that point in the same direction have led to a wide acceptance of the unit factor hypothesis, which is in reality an elaboration of the original Mendelian conception. According to this view certain heritable peculiarities are due to what might be called positive variations in the determiners while others are due to negative departures. When an individual showing the positive variation is mated to a normal, the offspring tend to show the characteristic (dominant), whereas in the other case the offspring are *apparently* normal, since the defect in the one parent is compensated by the normal condition of the other. Such apparently normal young, however, may be capable of transmitting the defect to their descendants. In the first case we have the *direct* form of heredity, in the second the *indirect* and the *collateral.*

In the peculiarities of the human eye numerous cases are found where the heredity of the defect is clearly of one of these types. The extensive family histories that have been published[2] seem to show, for instance, that stationary night blindness behaves as a dominant characteristic, whereas retinitis pigmentosa behaves as a recessive. An interesting special form of recessive characteristic is illustrated by peculiarties that behave in heredity like color blindness. Here in the vast majority of cases it is the male that is affected, the affection being transmitted from affected father through normal daughter to grandson. Such a characteristic is called *sex-linked,* and in the eyes of Drosophila several such peculiarities have been found. Detailed study of these characters has shown that the determiner for these sex-linked peculiarities, such as "eosin eyes", are located in the sex chromosome of which the male has one, the female two. The character is so much more unusual in the female then for the reason that the chances that her two sex chromosomes will *both* be defective are much less than that the single sex chromosome of the male will be defective. That the same chromosomal relations between the two sexes obtains in man has been reported by several cytologists; and since the parallelism in heredity is also complete, there is good reason to believe that color

blindness in man and the sex-linked eye defects of Drosophila are capable of the same explanation.

There are abundant data to show that many other eye defects of man are heritable in the same way as the peculiarities of lower animals; and it is of great importance for the advancement of our knowledge of human heredity to extend, so far as possible, the comparison between observations on family histories and the data obtained from experimental breeding.

But there is no reason why the study of human heredity should be confined, as it has so largely been in the past, to fitting data from human sources to the rules that are derived from investigations in other fields. The fact does not seem to be generally appreciated that for the study of certain problems in heredity man himself furnishes the best available material. No mammal is so well known, and few, if any, are more variable. His environmental influences are diverse and the methods for accurately recording his varying bodily conditions have been developed to a high degree. From the point of view of the geneticist the study of such an organism would seem to offer unusual opportunities. A few of the general questions that might be attacked by a study of human eye defects may be discussed briefly.

The question that arises first in connection with any abnormality of the eye is whether or not it really is hereditary. This is not always easily answered. The mere presence of the same defect in the eyes of several children of the same family or even of parent and child is not necessarily proof that the defect is hereditary; for, among other things, we always have to reckon with chance as a possible factor. For this reason it is important to know the normal incidence of the character in the general population. The higher the incidence the more difficult it is to prove the existence of an hereditary tendency; for if the chances that an individual picked at random will show a peculiarity are high, then the probability that several members of the same family will also show it is also relatively high. For instance, the chances that a child will be a boy are about even. Consequently in families of four children there is a mathematical probability that two of them will be boys in eleven cases out of sixteen. It is the high incidence of senile cataract that has made it difficult to demonstrate its hereditary nature. In the case of congenital cataract on the other hand, assuming that the incidence is as high as one in five thousand, the probability on a purely chance basis that a parent and two of his four children will show the defect is less than one in a million. Since congeni-

tal catracts are not distributed according to the laws of chance, but are commonly grouped among members of certain families, there is good presumptive evidence that this form of eye defect is hereditary.

But it does not necessarily follow from this that all cases of congenital cataract are hereditary. This brings us to a very important and difficult aspect of the study of heredity, namely, the question of the interrelation of environmental and germinal factors.

Writers have frequently failed to recognize that these two sets of factors are not mutually exclusive, as will appear from a review of the literature. The study of a large number of reported cases, however, will probably convince the reader that the same eye defect may be due primarily to hereditary factors in some cases and to environmental factors in other cases. The occurrence of cataracts other than congenital illustrates this point. What the result of these factors acting together or in opposition to each other may be the ophthalmologist is in a peculiarly favorable position to answer.

Some slight investigation of this problem has been undertaken in comparative lines. For example, in the studies on Drosophila, already referred to, it was discovered, apparently by accident, that in a given environment a certain peculiarity was inherited according to the regular rules; but when the environment was altered the proportions were changed, and frequently no abnormal young were produced. When, however, these normal appearing individuals were returned to the former environment, the original Mendelian proportion of defectives reappeared. Here then is a case in which the environmental factor is stronger than the hereditary.

We have not as yet the data for drawing final conclusions in regard to this matter; but it would seem that the various observations might be harmoniously interpreted on some such basis as the following, in which we may use for an example the case of cataracts which are not congenital.

There is much evidence to indicate that such cataracts are often of an hereditary nature. There is also abundant evidence that they may be produced by diseased bodily conditions or by purely external agents. There is probably no one in whom a cataract of some form could not be induced to develop, and it is possible that were the ætiology better understood there would be no one in whom the formation of a cataract could not be prevented. Thus it may be that the likelihood of a cataract being

formed is only a relative matter depending on the interaction of both hereditary and environmental factors.[3]

That the hereditary tendency in certain cases is very strong cannot, I think, be denied. Just what the physical basis of such a tendency is it is difficult to say, but some recent work on the heredity of pigmentation in the rabbit may throw a little light on this question. It was found[4] that in certain areas of the skin in a race of spotted rabbits an antiferment develops which prevents the oxidation of the pigment forming substance. The presence or absence of this antiferment, as determined by chemical tests, is inherited according to the strict Mendelian ratios. It is conceivable that a disposition to produce some substance that will act unfavorably upon the lens at some period of its existence may likewise be inherited in man. Whatever the predisposing factor may be, it is of interest to geneticists to know whether or not it occurs in varying grades of intensity, and whether there are to be found families in which a slight inherent tendency is seemingly present but manifests itself only under special conditions. Existing statistics do not seem adequate to settle this point.

Another point which ophthalmologists are in a position to elucidate concerns the question of the degree of fluctuation that a unit character may show within the limits of a single family. According to the pure line conception, developed in connection with animal and plant breeding, the individuals of a strain may fluctuate rather widely, whereas their germplasm varies not at all. If this is true of man, the children of a slightly affected individual have no better chances than those of his markedly affected brother. The evidence bearing on this question is at present conflicting.

Closely related is the problem of the first origin of defects. There is a suggestion in this connection from the work of Stockard[5] with alcoholized guinea pigs, where it is found that there may be artificially produced in the germ cells defects which are transmitted through several generations. Can the environment produce upon human germplasm variations which will make themselves felt in succeeding generations in the form of eye defects? If the germplasm can be thus affected, is the alteration permanent or, after a few generations, will the normal equilibrium gradually be restored? These are questions of the greatest importance, both practically and theoretically, and for their solution the study of the histories of human eye defects seems to be a most promising point of attack.

The one real difficulty in the study of all these questions is in getting adequate data from which to draw conclusions. If one might judge of a profession by its literature, it would seem that ophthalmologists as a class appreciate the importance of heredity better than almost any other group of physicians. But even among ophthalmologists there is a tendency to report only the striking cases and to overlook or disregard the supposedly normal relatives of an affected patient. This is very natural, and it is not surprising that the active practitioner often does not feel justified in taking the pains to look up a family which promises no special evidence or whose history might not seem particularly worth publishing if worked out. But such histories are important if we are really to understand the workings of heredity, and some method should be found for making the data available.

If the writer might venture a suggestion in this connection, it would be that in a center of population such, for example, as St. Louis, the local ophthalmologists report all cases of the eye defects whose heredity it is desired to study, to a secretary or other person who should correlate such reports and keep them open for consultation by members of the profession. Then whenever even a small amount of additional information might be gathered, instead of being laid aside or forgotten, it could be turned in with the feeling that it would be a real contribution toward a knowledge of the conditions that actually obtain in this community. Such records would increase in value as time goes on, and they would ultimately furnish the material for an intensive study of a definite region, a study which would have far greater importance than one based on data gathered at random from a variety of sources.

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1. The observations on Drosophila are summarized in "The Mechanism of Mendelian Heredity," by T. H. Morgan, et. al., New York, 1915.

2. Summarized by Bateson in "Mendel's Principles of Heredity," Cambridge, 1909. See also Usher: "On Inheritance of Retinitis Pigmentosa, with Notes on Cases," Roy. Lon. Ophthal. Hosp. Reports, No. 19, 1914.

3. Many of the ophthalmologists whose views are reported by Zydek (translation in this Journal, Vol. 32, pp. 235-247), seem to hint at some such idea. Somewhat similar views in relation to the heredity of cancer in mice are expressed by L. Loeb—Science, New Series, Vol. XLIII, No. 1105, 1916.

4. H. Onslow: "A Contribution to our Knowledge of Coat-Color in Animals and of Dominant and Recessive Whiteness." Proceedings of the Royal Society, Series B, Vol. LXXXIX, pp. 36-58, July, 1915.

5. Stockard and Papenicolaou: "A Further Analysis of Hereditary Transmission of Degeneracy and Deformities by the Descent of Alcoholized Mammals." American Naturalist, Vol. L, pp. 65-88, 144-177, 1916.

BONE TISSUE IN THE OPTIC NERVE, PIA MATER AND DURA MATER SHEATHS.

INFECTED THROMBUS IN THE ARTERIA CENTRALIS IN THE OTHER OPTIC NERVE. PATIENT DIED OF SEPTICÆMIA.

By Adolf Alt, M.D.,
ST. LOUIS, MO.

From the Laboratory of Ophthalmic Pathology, Washington University.

Dr. R. McB., 32 years old, became ill about April 1, 1915, while treating a lady affected with a very sore throat, evidently contracted from her baby. This lady had later on suppuration of the middle ear, and her husband developed facial erysipelas. From these patients pure streptococcus cultures were obtained.

Dr. McB.'s illness showed itself in a continued low fever, lassitude, lack of appetite, pains all over the body, irregular sweats and rapid loss of weight. The streptococcus viridans was found in his blood.

His condition, in spite of temporary improvement, became gradually worse. On September 28th, the patient having complained of loss of vision, Dr. Ewing found marked hæmorrhagic neuroretinitis in both eyes. Later on, a subconjunctival hæmorrhage appeared in the right eye and some petechiæ in the lower lid of the left eye. The patient died on October 17th.

The post mortem diagnosis was: septicæmia, acute endocarditis, chronic aortic and mitral insufficiency, lobar pneumonia, chronic intersitial nephritis, infarct of spleen.

Through the kindness of Dr. E. L. Opie, Professor of Pathology at Washington University, the optic nerves together with the posterior third of the eyeballs were given to me for microscopic examination.

The findings in part were extraordinary enough to warrant recording.

The right optic papilla under a low power showed only a moderate swelling. No definite hæmorrhages in the disc or the parts of the retina which I had obtained could be made out, although some small cavities in the neighborhood of the papilla and more peripherally had probably previously contained blood, which later has been absorbed.

The general appearance of the nerve and papilla is not that of a well developed optic neuritis, but rather of an œdema with a low grade neuritis.

Under a higher power this is seen more plainly. The optic papilla, though swollen, shows hardly any cell infiltration, nor are there any newly formed bloodvessels; but the nerve fibres are everywhere separated from each other by microscopically small spaces and cavities. Considerably larger cavities are found for a distance outside of the papilla in the ganglion layer, and even larger ones in the inner and outer nuclear layers, particularly the latter. Here the neuroepithelial cells have been pressed aside by the fluid. In the now empty cavities large stellated cells (glia cells) have remained, as it were, untouched by the former condition of pressure. (See Fig. 1.)

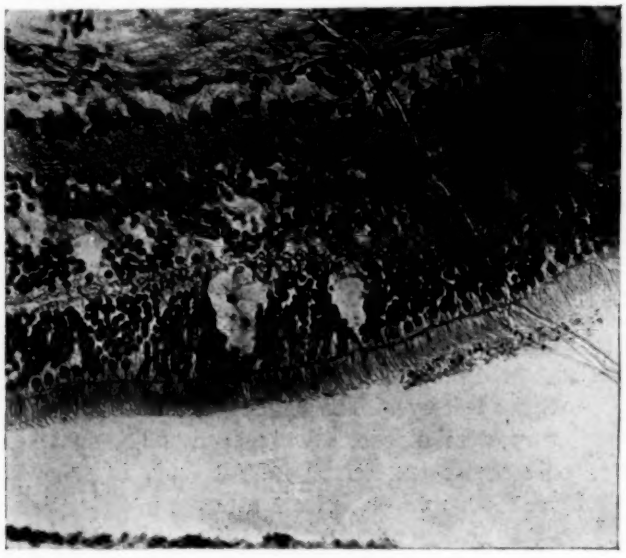

Figure 1.

Farther back in the nerve the symptoms of former œdema are little pronounced and the increase of cellular elements is comparatively slight.

Behind the locality where the central retinal artery enters the optic nerve, however, there are numerous smaller and larger round or oval holes, just as I have described them in a case of cerebral endothelioma (this Journal, Vol. XIV, January, 1897, Fig. 6, p. 10), and which I take to be the result of œdema.

In this part of the nerve there are furthermore a large number of amyloid (arenoid) bodies. (See Fig. 2, a.) They lie in the intervaginal space or the adjacent dura mater sheath, rarely

in the pia mater sheath. Such bodies, although found comparatively rarely in this region, are of course well known; but they are usually associated with atrophy of the optic nerve. There was no optic nerve atrophy in the present case. The origin of these amyloid bodies has been studied by a number of observers, especially by Th. Leber, whose exhaustive papers are to be found in von Graefe's Archiv in 1873 and 1879. In his second paper Leber changed his former opinion, that the amyloid bodies are due to a metamorphosis of nerve fibres, and states that "the amy-

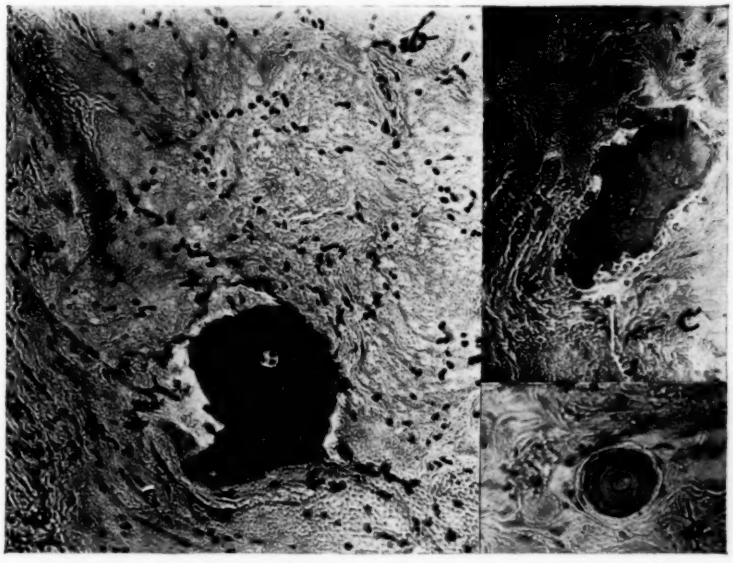

Figure 2.

a. Shows an amyloid (arenoid) body formed of concentric layers lying in the inner layers of the dura mater sheath. b. Transverse section of the optic nerve with bone formation within its tissue. c. A bone plate lying in the inner layers of the dura mater sheath.

loid bodies of the nerve tissue are enclosed within neuroglia cells and their offshoots and, therefore, probably originate within these" (page 330). The amyloid bodies in our case, as far as I can find, lie invariably outside the nerve tissue. As stated before, they lie in the intervaginal space or the inner layers of the dura mater sheath, free or attached to some connective tissue trabeculæ. It seems then that in this case their origin cannot, without further evidence, be sought in neuroglia tissue; they seem rather to derive their origin from a metamorphosis of con-

nective tissue fibres. This seems the more probable, since there are numerous similar round bodies here and there in the connective tissue trabecules which show no concentrically arranged layers, and do not give the amyloid reaction, but are apparently undergoing and have undergone a hyaline metamorphosis. These hyaline bodies are sometimes covered with a layer of flat cells, in others these flat cells are absent.

There are furthermore amorphous masses of amyloid tissue lying here and there; also in the small parts of orbital tissue attached to the outside of the optic nerve sheath.

While the conditions here described are interesting indeed, they have been seen by others and myself before. The occurrence of bone tissue in the optic nerve, however, seems to be an absolutely unique observation.

In a number of transverse sections of the optic nerve, posteriorly to the entrance of the central retinal artery, there is a small irregularly shaped body composed of bone tissue. Its well-distinguishable layers, with canals and bone cells, are concentrically arranged around a small vessel containing a few (endothelial?) cells. Thus this bone tissue appears to have taken its origin from the vessel walls. (See Fig. 2, b.) It may be that it started from an amyloid degeneration of the bloodvessel walls, followed by infiltration with lime and transformation into bone. The likeness to so-called colloid bodies of the lamina vitrea of the choroid which have changed into bone tissue is apparent.

The connection between this bone tissue in the optic nerve tissue and the amyloid deposits seems the more probable since I have, furthermore, found a larger bone plate in the inner layers of the dura mater sheath (See Fig. 2, c), and a smaller one in the pia mater sheath. Bone formation in the dura mater sheath has once previously been seen.

Whether these remarkable changes in this optic nerve have anything to do with the chronic septicæmia to which the patient succumbed or not, I do not venture to say.

The left optic nerve shows in part very different conditions. In the slightly swollen optic papilla and retina I find the same evidences of œdema as I did in the right ones. Particularly the round and oval holes in the posterior part of the nerve are equally numerous and well developed. No hæmorrhages are found in the portions of the retina forming part of my specimens. There is, however, a much further progressed neuritis than in the right one. I have found no amorphous amyloid

masses, nor amyloid bodies in this nerve or its sheaths, nor any bone tissue. But just in the knee formed by the retinal artery when entering the central canal in the optic nerve, there lies a large thrombus. This thrombus, consisting in the main of fibrin, is adherent to the bloodvessel wall on one side, while by shrinkage it has evidently withdrawn from it on the other one. Embedded in this fibrinous mass are numerous polymorphonuclear leukocytes and a number of strings of streptococci. Thus it appears that this thrombus is not of very recent date and was secondarily infected by the streptococcus. While in this situation in the longitudinal sections it appears like a round mass and confined to this one locality there are several more elongated thrombotic masses found in parts of the central retinal artery nearby, so that it was in reality probably of some length. This point can, however, not be definitely decided, as no section shows the whole thrombus mass.

In both eyes the choroid, as far as included in the posterior parts of the eyeballs examined by me, shows numerous separate foci of round cell infiltration. There is, however, no general choroiditis. It may well be that these foci are due to streptococcus invasion, but staining attempts proved unsuccessful.

I wish to acknowledge my indebtedness to Dr. H. D. Lamb for preparing the sections for my study.

FILAMENTOUS KERATITIS.

CLINICAL REPORT OF A CASE.

By Samuel Horton Brown, M.D.,
PHILADELPHIA.

The occurrence of trophic changes in the corneal epithelium in the course of glaucoma and chronic iridocyclitis, as well as in definite neuroparalytic conditions, is by no means uncommon; but a condition not unlike these trophic alterations in many particulars is occasionally observed, which is classified as filamentous keratitis, and which provided the occasion for this brief clinical note.

The patient in this instance was a woman sixty-one years of age, who was also the subject of senile cataract in both eyes. The cataract in the right eye had reached maturity and extraction was deemed advisable. A preliminary iridectomy was performed, followed after an interval of a few weeks by the ordinary linear extraction operation. The lens was hypermature and the incision was rather far forward, resulting in the removal of only a portion of the cortex and the retention and luxation of the nucleus up and behind the ciliary body. The profuse escape of an extremely watery vitreous body seemed to justify closing the wound immediately without further interference.

A very small amount of reaction followed with little or no pain, and an uninterrupted but prolonged convalescence followed. Correcting lenses ultimately brought the vision of this eye to 5/15.

Convalescence was protracted, first because the patient seemed to lose all strength upon going to bed for the operation, and would not show the slightest tendency to recover his strength until resort was had to forced feeding and tonics. At the end of ten days the eye operated upon was in as good condition as the average good case, but the patient was too weak to leave her bed, although she was perfectly tractable and an extremely reasonable woman.

At the end of two weeks from the operation, while the patient was still in bed, she complained of the sensation of a foreign

body in the left eye (the unoperated eye), and examination showed the presence of one or two vertical linear scratches on the cornea with a rolling up of the epithelium that should have covered these denuded areas. At first they were regarded as scratches due to inadvertently rubbing of the eye by the patient in a restless moment, but repeated examinations showed that these lesions were of a different character. Their direction was parallel with the long axis of the body—vertical in so far as the eye was concerned—and the corneal epithelium hung from them in shreds which could be removed readily with an applicator.

Within twenty-four hours new epithelium covered the old lesions, but new lesions were to be observed. At no time did the condition manifest any vesicular or bullous formations in the corneal epithelium, nor did the cornea show any dense deep or superficial infiltration. There was a moderate amount of conjunctival and pericorneal injection. The patient complained of no pain but did experience considerable distress on exposure of the eye to light, and on motion. This condition persisted for a period of four to six weeks. At no time did the operated eye show any signs of the affection.

On account of a brief absence from the city, the patient was placed in the care of Dr. Harold G. Goldberg, of this city, who noticed a similarity in the history and clinical manifestations of this case, to a case jointly reported by Dr. Wm. Zentmayer and himself ("A Case of Filamentous Keratitis"—Wm. Zentmayer and Harold Goldberg, *Ophthalmology*, April, 1906). In this case, the lesions were tiny vesicles that terminated in a slender filament. It was impossible to demonstrate such a condition in the more recent case, probably by reason of faulty technic. The duration in both was rather long, although two months covered the condition in the latter case.

Recovery was brought about by forced feeding, rest in bed, tonics, and locally atropin and holocain. Bandaging the eye was beneficial at first; later removal of the bandage was of greater value. The distress and the sensation of a foreign body in the eye was so great, that one drop of a one per cent. holocain solution was necessary once, sometimes twice, a day to afford comfort to the patient. In our experience with painful trophic conditions of the cornea, the relief of the pain and distress is essential to the recovery of the cornea as well as to the comfort of the patient, and this is best afforded by holocain.

No bacteriologic study was made in this case as in the case referred to by Dr. Goldberg; but on account of the watery condition of the vitreous body in the operated eye, and the extremely slow return to normal of the general health, we are inclined to assume that the corneal condition was but a part of a general disturbance of nutrition, as well as a disturbance of the trophic ocular influence.

ON TRANSPLANTATION OF THE LENS AND GLOBE.*

By Professor Dr. A. Fischel, Prag.

In a study which I made concerning a problem in general morphology, the eye and lens were used as objects of experimentation. The results of this study will be published in extenso in Vol. XLII of the Archives of "Entwickelungsmechanik der Organismen" (mechanics of development of the organisms) in a paper under the title: "On retrogressive development."

They appear to me to be of especial interest, in part at least, to the ophthalmologist on account of the object of experimentation. This part I wish to report here in short, the details must be studied in the larger paper.

The larvæ of salamandra macul., living in water and about 30 mm. long when the transplantation was performed, which formed the material for my studies, possess an in the main perfectly differentiated eye with a large, well formed lens. If this lens is removed from the eye and transplanted into the connective tissue in any part of the body, the lens remains well preserved at its new place for a long time but undergoes slowly a very peculiar retrogressive transformation.

First, the transplanted lens changes its general shape according to the space at its disposal. This rapid change of shape proves that the lens possesses a high degree of plasticity.

The lens does not heal into the connective tissue, yet it does not share the fate of other transplanted masses which do not heal into the tissue. It does not disintegrate, it is not permeated and destroyed by wandering cells, but it undergoes a retrogressive transformation in that its fibrous material grows gradually less and less and finally disappears altogether. This reduction may be combined with a simultaneous degeneration of the fibres.

On the other hand, the epithelial cells of the lens at first retain their size and shape and undergo a retrogressive metamorphosis only in the final stages of the whole procedure.

The forms which during this process are assumed by the lens are very similar to those through which it passes during its normal development, only they develop now in a reverse sequence. The fully differentiated lens, first is changed into one with a

*Klin. Mtsbl., Vol. LV, p. 528.

small quantity of fibres, then after the fibres have disappeared into a purely epithelial vesicle which is like the lens vesicle of normal development. We can therefore compare this process to those which are usually designated as "retrogressive or reverse development." This term is, however, justified in a very narrow sense only, which we can here not discuss. It is just this process of reverse development of the lens which is valuable in studying the question.

After a purely epithelial vesicle has been formed this, too, is reduced until finally the whole lens is absorbed and gone without leaving a trace. During these processes of reduction, however, there appears at certain stages a very lively cell increase in the epithelium of the lens. This may be so great that small accessory lens vesicles or cell masses are formed which grow into the interior of the lens.

Not only whole lenses, but parts of the lens fibre mass have a like fate. The process of their retrogressive development takes the longer the larger they are and the firmer their elements remain held together.

These cells of these transplanted pieces do not join with the tissue of the site of the implantation, but remain sharply distinct from them. The lens, therefore, preserves very strongly its peculiarity in comparison with other tissue cells, even at the final stages of the retrogression when its cells are already near disintegration. The same is the case if a lens or parts of one are transplanted into the epithelium of the skin, although this is genetically a very near relative of the lens.

It appears from this that the cells of the lens by their internal and probably by their chemical peculiarities differ materially from other tissue cells, even, from those of the epithelium of the skin which are of the same derivation, and behave like foreign elements.

While this transformation resulted always when the lens alone was transplanted, it did not take place when with the lens, the inner parts of the eye, especially the retina, had been transplanted. From this is seen that the lymph contained in the cutaneous connective tissue cannot serve as nutritive fluid for the isolated transplanted lens and that the normal nutritive fluid in the eye must contain special parts which, produced by internal secretion, reached the lens cells from the retina and perhaps, too, from the inner tissue cells of the eye. This material is absolutely necessary for the preservation of the lens. When, therefore,

the lens alone is transplanted and thus withdrawn from the influence of these materials it retrogrades.

Aside from the changes in the lens there are, also, changes in the tissue cells at the site of the transplantation. We are especially interested in those of the cutaneous epithelium. This is transformed in such a manner that it loses its characteristic signs. The normally present one-cell glands, Leidig's cells, so-called, retrograde and thus the morphological as well as the physiological character of the epithelium is altered; other changes concern the arrangement and peculiarities of the remaining cells. The entire result may be summed up in the statement that the epithelium assumes an aspect very similar to that of the earlier stages in its development and which—in the completely developed organism—can be likened to that of the corneal epithelium. In any part of the body such a transformation can be produced. It may, furthermore, be brought about not only by the lens and lens portions, but also by an eye deprived of the lens, by pieces of the inner membranes of the eye, even by disintegrated parts of them and by the tissue juice. A close study of these conditions proves that the cause of this transformation of the epithelium is of a chemical nature and is represented by material which is formed by the cells of the lens and the inner membranes of the eye and acts on the epithelium as a formative stimulus.

Since this material is formed probably normally in the eye and acts on the cornea, the assumption is natural but it has something to do with the preservation of the normal cornea, or at least its epithelium.

In consequence the existence of the lens and of the cornea in the normal eye is dependent on material which originates by internal secretion within the eye itself.

From developmental mechanics experiments made in the past few years it is shown that the lens and corneal epithelium—at least in certain animals and especially in those we are interested in—are not contained preformed in certain definite and limited localities of the ectoderm. At early stages of the development on the contrary the whole ectoderm, or at least a large area of it, possesses the faculty to produce lenticular or corneal epithelial cells. What area of the ectoderm is to produce these depends on the eye cup, and the lens. Wherever these place themselves against the ectoderm, then lens and corneal epithelial cells are differentiated.

It is still a question whether the influence of the contact or of a chemical effect act more decisively on the ectoderm. The results of this study make it appear probable that in the embryo already eye and lens produce and give off material which take an important part in the development of the lens and cornea. The origin of these organs is therefore not, or at least not principally, dependent on contact influence but on chemical causes, since material is formed within the eye which acts as a formative stimulous on the ectoderm. Even embryonic organs are therefore capable of producing an internal secretion and this secretion may take an important part in the organ development.

The transformation of the cutaneous epithelium which in a the eye is necessary for the preservation of the lens renders the peculiar retrograding processes in the transplanted lens which we have just described more clear. In consequence of the lack of the normal nutrient fluid of the lens, that is through a trophic cause, the fibres disappear. Thus the lens must gradually assume forms which are similar to those of its development until it forms a purely epithelial vesicle. In consequence of the continually unfavorable trophic conditions this also retrogrades and is absorbed.

The transformation of the cutaneous epithelium which in a certain sense is a "reverse" development, is plainly dependent on the lack of normal conditions in the connective tissue or due to irritating action produced by the transplanted tissue.

Thus these two kinds of "reverse development" are in the main explained by trophical conditions, without the aid of a special tendency to reverse development. It is also plain that such processes of "reverse" development cannot without further study permit of those far reaching conclusions which have been drawn from them by others in a general biological sense.

MEDICAL SOCIETIES.

POLYCLINIC OPHTHALMIC SOCIETY,

PHILADELPHIA, PA.

Stated Meeting, Thursday Afternoon, December 9th, 1915.

Dr. Wm. Zentmayer, Chairman.

Subject, "THE ACCESSORY SINUSES OF THE NOSE."

The Anatomical Relationship of the Eye to the Accessory Sinuses.—Dr. J. P. Tunis (by invitation). (Abstract of remarks illustrated by forty lantern slides.)

The close anatomical relations between the accessory sinuses and the contents of the orbit are abundantly proven both by dissections of these parts in the cadaver and by rapidly accumulating clinical evidence. The greater the amount of anatomical material examined the more one is impressed with the wide variation in the size and capacity of these air spaces. It follows that the larger they are the closer become their relations to the orbital contents. These observations are based on an examination of several hundred adult skulls and over five hundred wet preparations. Briefly the optic nerve or some equally important part of the orbital contents, may come in close touch with the frontal, the posterior ethmoid, the sphenoidal sinus or the maxillary antrum, by the overdevelopment of these air spaces. This can be readily proven by reference to my specimens.

The sinusitis which is most apt to cause optic neuritis develops either in the posterior ethmoid or in the sphenoid. Frequently this all important nerve may be seen occupying a canal of it own, running through the posterior and outer part of either one of these spaces. The works of Onodi are particularly rich in such material. About a dozen of my lantern slides are copies of his illustrations. On one side the optic nerve may come in close relation with the sphenoidal sinus and on the other with the posterior ethmoid. In several of these specimens the optic nerve was separated from these air spaces by a tissue covering no thicker than an ordinary sheet of writing paper. In such case chronic inflammation of the spheno-ethmoidal space could readily infect the optic nerve.

As illustrating the great variation in the development of these sinuses let us take, for example, the sphenoid. As a rule the sinus develops in the body of this bone only, with an average capacity at maturity of about 4 cc. Frequently, however, this development may extend outward into one or both of the greater wings of this bone with corresponding increase in the size and capacity of the sinus. It is in such cases that special canals for the optic nerve are developed.

Similarly, one of the specimens shows such a very considerable development of the frontal sinus posteriorly as to bring it in close touch with the optic foramen. Clinically, in such cases, frontal sinusitis *per se* might readily have caused optic neuritis.

Chronic inflammation of the maxillary antra may extend upward to the orbit, especially if these spaces are of more than average size. In this connection it is well to bear in mind the fact that patients past middle life have thinner roofs to their antra than those of less mature years. In other words, as we pass the age of forty-five nature, as a rule, brings about a gradual absorption of the bony part of the antral roof more or less, so that as age advances this separation between the antrum and the orbit becomes more and more membranous.

In this connection let me quote from an article of mine in the *Laryngoscope* for October, 1912: "Sphenoidal Sinusitis in Relation to Optic Neuritis." 1. Anatomically, the posterior ethmoid and the sphenoidal sinus must be regarded as having practically the same intimate relations with the optic nerve. 2. Infection of the optic tract by the spreading of sphenoidal or posterior ethmoidal sinusitis is due more to continuity and proximity than to any peculiar arrangement of the lymphatic system in this region. 3. Sphenoidal or posterior ethmoidal sinusitis may occur independently and unassociated with frontal sinusitis or antritis. 4. When the sphenoidal sinus is the seat of chronic inflammation the importance of a prompt diagnosis and the institution of equally prompt remedial measures cannot be too much emphasized.

The Optic Nerve in Affections of the Sinuses.—Dr. Wm. Zentmayer.

It could not be otherwise than that such a highly specialized nerve as the optic, having such a close anatomic topographic relation to mucous lined cavities, should suffer at times when these cavities are the seat of inflammation. At the same time it

must not be overlooked that considerable protection is afforded by the periosteum. The analogy that one hears at times drawn between these structures and the appendix, is not a close one, as in the latter instance we have to do with a rudimentary structure where as in the former we have, developmentally at least, normal structures.

The changes in the optic nerve manifest themselves as a retrobulbar neuritis, papillitis of a slight degree, and an actual papillœdema. The relative frequency of these conditions calculated from the case reports published recently by Elschnig shows that in unilateral cases, retrobulbar neuritis is present in 20 per cent., papillitis occurs in 55 per cent., papillœdema in 25 per cent. In bilateral cases retrobulbar neuritis occurs in 45 per cent., papillitis in 33 per cent., papillœdema in 16 per cent. This gives a papillitis in about one-half of the cases. The distinction between these groups I have based on the ophthalmoscopic findings—negative, slight haze or swelling of the papilla, and decided œdema and prominence of the papilla. The visual disturbance occasioned varies from slight impairment to absolute blindness. The onset is relatively rapid. When it is possible to take the visual field, in about 25 per cent. of the cases a central scotoma will be found, absolute in some and relative in a fewer number. The findings in the studies made of the blind spot have not been harmonious. Hoeve, who first studied them, found enlargement for color. This was confirmed by Gjessing, who found it in 50 per cent of his cases. It should be stated that lately observations would indicate that it by no means occurs with this frequency, certainly not as an early symptom. Among exceptional field findings are ring scotoma and peripheral contraction.

Changes in the Orbit.—Dr. Wm. Campbell Posey.

It is now generally recognized that inflammation of the orbit of endogenic metastatic origin is rare, and that most diseases of this cavity are ectogenic, being occasioned by an inflammation of one or more of the accessory sinuses of the nose. The character of the symptoms and the form of inflammation which the disease of the sinus excites in the orbit, depends first on the particular sinus or group of sinuses affected, and secondly, on the nature of the inflammation of the sinus. Thus, for example, a chronic distention of the walls of a sinus (hydrops) may occasion dislocation of the globe, with the necessary attendant of

more or less functional derangement of the occular muscles, giving rise to asthenopia or actual diplopia; or the refraction of the eye may be altered by pressure, causing changes in the axis or the amount of the astigmatism, and, finally, disturbances in the proper canalization of tears may result from a displacement of the puncta lacrimalia, or by a lesion in Horner's muscle in the lid. In chronic cases, vision is but rarely affected, for even when there is exophthalmus, the sigmoid flexure in the optic nerve permits it to elongate and escape injury from the traction to which the displacement of the globe subjects it; in acute inflammatory processes of the orbit, on the other hand, vision is apt to be more or less impaired, either from the very pronounced displacement of the globe which occurs in this class of cases, or from a direct implication of the nerve itself in the inflammatory process.

One of the earliest signs of the involvement of the orbit is a change in the contour of the orbital ring. Usually this is occasioned by a distinct projection into the orbit cells, but at times the rim may be simply raised and roughened, either wholly or in part, by periostitis. In some cases of sinusitis an acute cellulitis of the orbit may develop without premonitory signs, and lead to the formation of an abscess, which may point and discharge itself either externally through the skin of the lid, or in rarer cases into the antrum, nose or tear sac. In other cases the sinusitis causes a circumscribed swelling to appear in various parts of the orbit, which may be either as hard and unyielding as bone, or may convey to the finger the impression of containing fluid.

Although it is frequently impossible by means of the ocular symptoms alone to make a differential diagnosis of the particular sinus involved, in many cases the character of the displacement of the eyeball is of significance. Thus, disease of the frontal sinus, which is the most frequent form of sinusitis to occasion dislocation of the globe, by reason of the extreme thinness of the bone which separates its cavity from the orbit, causes the eyeball to be displaced down and out. Mucoceles formed from the ethmoid cells are circumscribed, and do not as a rule occasion any considerable diminution in the size of the orbital cavity; when displacement of the globe does occur, however, it usually is up and out. Dislocation from a mucocele of the sphenoid cells is uncommon, as in the rare cases in which mucocele develops in these sinuses, the anterior wall, being the thinnest, is the first to give way and the orbital cavity escapes compression.

The orbit enjoys a similar immunity in hydrops of the antrum, for the inner wall of these cells is the thinnest and is the first to yield, and the nasal cavity is encroached on. Proptosis always indicates pressure from behind the globe.

The location of the pointing of the abscess may also be of value as indicating the particular sinus which is affected; abscesses of the frontal sinus tending to perforate at the middle of the uper lid, or at the superior angle of the orbit, and those due to ethmoiditis at its lower inner angle. A general orbital cellulitis may be occasioned by an acute perforation of any sinus. Disease of the frontal sinus may be frequently diagnosed by redness and swelling of the skin over the sinus, and by the pain which may be elicited by pressing on the roof of the orbit in the neighborhood of the pulley of the superior oblique muscle; indeed it is often possible to outline the area of the sinus by noting the extent of the tenderness.

Dr. Zentmayer (closing). It is to be regretted that time did not permit Dr. Tunis to refer to the anomalies met with in the accessory sinuses. In a recent paper on "Contralateral Visual Disturbances", Onodi describes instances in which the sphenoid sinus is separated from the homolateral optic nerve by a dense plate of bone, but is in contact with the optic nerve of the contralateral side; also an instance in which the two sinuses are superimposed; also one in which the left sinus is in contact with the right optic nerve.

It would seem reasonable to suppose that a sinusitis would produce a uveitis through absorption of toxins just as a focus of pus anywhere in the body may be responsible for a poly-arthritis.

Dr. Reber's statement that a bilateral indicates a systemic cause, whereas a unilateral lesion points to a local cause, is not borne out by Elschnig's series, as he had more bilateral than unilateral cases.

WALTER W. WATSON, Secretary.

ABSTRACTS FROM MEDICAL LITERATURE.

By W. F. Hardy, M.D.,
ST. LOUIS, MO.

THE INDICATIONS FOR THE OPERATION OF STRABISMUS.

Reber (*Penn. Med. Jour.*, May, 1915) feels that despite the amount that has been written on strabismus there still exists a diversity of opinion as to when and how to operate. Factors determining this are: (1) Whether the patient is a clinic or private one. (2) Age. (3) Whether orthoptic treatment has been carried out. (4) Whether the squint is monocular or binocular. (5) The rotational power of each eye individually.

With regard to (1), haste is more necessary in clinic patients because they will not remain under observation or subject themselves to careful study and training. In the average clinic case, if improvement has not occurred after several months of wearing accurately fitted glasses, then operation is in order. The same may be said in great degree of out of town patients.

(2) The age of the patient is of great importance The ideal age is from 14 to 16; then in all probability the refraction has long since been carefully worked out. The head has developed and the outward swing of the orbital axes has to a large extent taken place. The eyeball has attained adult size. The patient has gained power with the externi; and finally, and most important, the operation can be done under local anesthesia. Early operation in congenital paresis or palsy is often justifiable.

(3) The question of previous orthoptic treatment is very important. Reber is decidedly averse to operation in any case until a proper refractive correction has been given and worn, and training of binocular vision attempted with the stereoscope, amblyoscope, diploscope and bar reading.

(4) Many things enter into the question as to whether the strabismus is monocular or binocular (alternating). The latter condition is comparatively rare. In such cases there is total absence of the fusion faculty and may be operated upon early (from the fifth year on). In a monocular squint one eye constantly fixes and the other constantly deviates. Here Reber thinks a division into two classes should be made, viz.: those whose deviating eye has a vision of one-fourth or better, and

those with a vision less than one-fourth, for the reason that in the former the deviating eye can and does at times take part in reading, writing or sewing, and occasionally the better eye will deviate. This then is not a true monocular type but verges on the binocular. There are, therefore, three types of functional strabismus: (*a*) true alternating, (*b*) incomplete binocular, (*c*) true monocular strabismus. Incomplete binocular strabismus and true alternating strabismus the surgery should generally be divided between the two eyes. In true monocular squint the surgery should be confined to the deviating eye. If needed, the fixing eye can be operated upon later. The age is here again a large factor, for in childhood and adolesence the convergent forces are in the ascendency, while in later life it is the divergent forces ascendent. Because of the role of accomodation, Reber thinks that in youth the divergent forces should be increased, therefore advancement is in order.

(5) The rotational power should be determined roughly on the perimeter or carefully with the tropometer, if one is possessed. In alternating squint, temporal rotation is usually much deficient in both eyes. The fixing eye in monocular squint has, as a rule, normal rotating power, while the squinting eye is much deficient. The older the patient the poorer the temporal rotation because of the spastically contracted internus and structurally weakened externus. A well chosen tenotomy is often necessary; but in young people where time is not a factor the preference should be given to advancement. Operating under general anæsthesia is unsatisfactory and inexact, and whenever possible local anesthesia is to be preferred, counting on the co-operation of the patient and the presence of normal innervation of the ocular muscular structures. Both eyes should be bandaged for at least three days; and Landolt is mentioned as making it a rule to bandage the eyes for eight days.

TYPES OF HYDROCEPHALUS.

While the article by Frazier (*Am. Jour. Dis. of Children*) is intended to interest pediatrists, yet there is much in it which concerns the ophthalmologist, especially the case report given. The old classification of hydrocephalus into internal and external is discarded by Frazier. He offers the following as a new designation: (1) Hydrocephalus obstructivus. (2) Hydrocephalus non-absorptus. (3) Hydrocephalus hypersecretivus. (4) Hydro-

cephalus occultus. The first is due to perhaps a congenital defect, as the absence of the aqueduct of Sylvius, or blocking of the foramen of Munro, or of Majendie and Luschka, or the result of a pre-existing inflammatory lesion (meningitis). The cerebrospinal fluid is secreted by the choroid plexus and absorbed by the venous channels. Hence a failure on the part of, or obstruction of the veins, in absorbing the cerebrospinal fluid will result in the second type of hydrocephalus. The third type is due to oversecretion. As thyroid extract has an inhibitory effect on the output of cerebrospinal fluids it is possible that dysthyroidism may allow of hypersecretion. This is not proven, however. The fourth type, occult hydrocephalus, is characterized by excess of fluid in the ventricles, basal cysternæ and sometimes throughout the subarachnoid space without necessarily any increase in the cranial dimensions. Now what has this latter to do with ophthalmology? viz.: this, that the symptoms produced are closely allied to those of brain tumor; papillœdema may be produced and the saving of sight may depend on an early recognition of the true condition and its immediate alleviation. The surgical treatment does not concern us here. Where hypersecretion is present it is interesting to note that Frazier resorts to thyroid feeding. A brief sketch of the case report may not be out of place. The child, 3 years of age, had a series of eight convulsions, complained of headache and vomited frequently. Physical examination did not reveal any focal symptoms suggestive of intracranial tumor except as to gait. Vision was defective. Double papillœdema present. Decompression was done and considerable quantity of fluid evacuated. Then followed a large cerebral hernia under great tension. The papillœdema soon subsided, revealing a well marker post papillitic atrophy, convulsions ceased and all symptoms disappeared except that vision remained impaired. An examination three years later showed the child to be in perfect health. The degree of optic atrophy indicated very positively that the duration of the primary lesion was much longer than was to be inferred from the history.

ECONOMY IN THE USE OF DRUGS.

An editorial in the *Antiseptic,* an Indian medical journal (August, 1915), deals with the economy in the use of drugs during war time. Why waste in war time should be condemned and in peace time tacitly condoned is hard to understand unless

it be the result of the pinch of necessity. Why waste at any time? Nevertheless the main contentions are correct. If an effect can be obtained to the extent one desires, with a 1 per cent. solution of a drug, there is manifestly no sense in habitually using a 5 per cent. solution. If drugs were always ordered for definite effects only in minimal doses and prescribed with a high order of intelligence it would be so much the worse for the manufacturers and so much the better for the patients. The editor of *Antiseptic* states that in respect to drugs the most costly department of modern medicine is that of the ophthalmic surgeon. Relatively this may be so, though the total quantity of any drug dispensed to an eye patient is small. The use of an atropine solution stronger than 2 grains to the ounce of water is condemned. This strength solution is claimed to fully paralyze the ciliary muscle so that any greater strength is useless and a waste of drug. This is in marked disagreement with text-book advice in which greater strengths and even the use of atropine crystals is advised. A similar plea is made for eserine. Myosis is the desideratum and this is accomplished with small doses, the author stating that ⅛ of 1 per cent solution being all that is needed. This applies, it must be said, chiefly in the treatment of chronic glaucoma. Strong solutions of eserine cause ciliary pain and conjunctival irritation. Where the reviewer finds himself in most hearty accord with *Antiseptic* is in the discussion of the use of silver nitrate. Throughout the article reference is made to sledge hammer methods in treatment, attempting, as it were, to knock out with one blow, the pathological condition. Silver nitrate has been and is used yet in such manner. Rarely is it necessary to use a greater strength than one grain to the ounce of water, in which strength it may be used more frequently than it would be wise to use stronger solutions. Furthermore it causes little discomfort and is markedly efficient. It is impossible to secure sterilization of the conjunctival sac and it is, as stated, to suppose that a strong solution of silver nitrate must necessarily be more effective than a weaker one in the treatment of a gonococcal infection, opposed to fact. The article concludes with a Lister-Lawson Tait anecdote apropos of the subject. Lister was experimenting at Edinburgh while Tait was hurling his attacks at Lister from Birmingham. One day Tait said, "Lister's solutions are getting weaker and his arguments are getting stronger." "Quite so," said John Chiene, Lister's assistant, "Lister's arguments are getting stronger *because* his solutions are getting weaker."

THE DETERMINATION OF THE RELATIVE POSITION OF REST BY PROLONGED OCCLUSION OF ONE EYE.

The ordinary rapid office methods of ascertaining the relative position of rest are deemed inefficient and inaccurate by Marlow (*N. Y. State Journal of Med.*, November, 1915). He uses prolonged occlusion of one eye but clearly states that it is not a method for routine use. The cases must be selected and are usually in patients with inveterate asthenopia, who have been unrelieved by refractive treatment. The occlusion has been kept up for varying periods of time, from one to ten days, a good working average being a week. The method adopted for putting the procedure into practice has consisted in replacing one of the patient's lenses with a ground glass. It is necessary to occlude the proper eye. This may be decided by the visual acuity, the more defective eye being covered or in cases where there is no difference by allowing the patient to decide whether he is left eyed or right eyed by looking at a distant light, with both eyes open, through a ring held at arm's length. If the light is sighted with the right eye the left is occluded.

At the end of the occlusion period, lenses correcting the refraction and a Maddox rod are placed in a trial frame, the patient is made to close his eyes, the occluding glasses removed and the trial frame substituted for them. The patient opens his eyes and the deviation is measured in the usual way. A table of ninety cases is given by the author. The percentages obtained are as follows: Parallelism, 7 per cent; divergence without hyperphoria, 17 per cent; divergence with hyperphoria 41½ per cent; total 58 per cent. Convergence without hyperphoria, 4½ per cent; convergence with hyperphoria, 5½ per cent; total, 10 per cent. Hyperphoria without lateral deviation, 24½ per cent.; R. 9 per cent.; L. 15½ per cent; hyperphoria with lateral deviation, 47 per cent, or 71½ per cent. of all cases. Marlow is not averse to using prisms and has no hesitancy in prescribing them in selected cases. Some instances show that the exophoria found after occlusion may exceed in amount the abduction measured before occlusion. High abduction suggests exophoria but does not indicate its limit. Prism exercises have the tendency to cover up or render latent errors which in their latent condition may continue to give rise to symptoms. It is a matter of common observation that the use of prisms to correct a portion of

a latent deviation is followed in many cases by the manifestation of a higher degree of error. It is also true that such manifestation occurs with greater rapidity and completeness if the binocular function is entirely annulled by occlusion, and the occluded eye is allowed to take up its position of rest. Some of the most severe cases of photophobia met by Marlow, not due to inflammatory conditions, have been caused by latent heterophoria, particularly hyperphoria. Prolonged occlusion brings this latent condition to light. Obstinate and high grade cases are remedied by tenotomy. The tendon is never completely severed, the marginal fibers being left intact. Emphasis is laid on the after treatment. The effect of the operation depends largely upon leaving the eye open, and insisting upon the use of the two eyes together immediately after operation. The use of the method of prolonged occlusion suggested the following conclusions: (1) That the ordinary methods, at any rate when used only for the short periods possible during a consultation, may fail to reveal the kind and particularly the amount of error present. (2) That while the method tends to show the true position of rest, the periods during which it is convenient to use it are insufficient to render the whole truth in the matter manifest. (3) That while the constant use of prisms tends to bring out the heterophoria, prolonged occlusion accomplishes this with much greater rapidity and is free from the objections urged against prisms. (4) That the total exophoria may greatly exceed the abduction as measured previous to occlusion and the same may be true of other forms of heterophoria.

OCULAR MANIFESTATIONS OF FIFTH NERVE IRRITATIONS.

The paper by Cary (*Southern Medical Journal,* February, 1916) is a discussion of those ocular affections usually designated reflex, arising from fifth nerve irritation and with special reference to nasal irritation. He evidently feels that men cannot well limit themselves to ophthalmology, for he states "that if there was nothing else to prevent a man limiting himself entirely to the practice of ophthalmology, the peculiar inflammation of the eye so often traceable to nasal conditions would in itself make of every ophthalmologist a persistent rhinologist." Obscure cases of uveitis, hyalitis, vasomtor disturbances with corneal erosions may often be traced to nasal iritation and relieved

by proper rhinological treatment. The irritation may come from spurs, ridges, cystic middle turbinals, inflamed ethmoids and trouble in any of the sinuses. This is apt to be the case where there is no discharge or active process of any kind.

The sympathetic is credited by Cary in playing a very important rôle in the ocular reflex disturbances in which circulatory phenomena are pre-eminent. Increase and decrease of tension, also detachment of the retina in certain special instances, may result from vasomotor disturbances. Cary thinks that it is possible for zones of irritation within a given area of the nose to so disturb the ciliary ganglion that the sympathetic nerve distributed through the ciliary ganglion will lose domination of its function over the vascular part of the eye where the fifth nerve and sympathetic control and through the simplest irritation there may be disturbed function manifested. The author believes that localized overgrowth of tissue such as occurred in a few cases of vernal catarrh. observed by him and in other localized growths of tissue in the upper lid (conjunctival surface) in which infection was probably not the cause, to be brought about by trophic disturbances. He mentions certain types of conjunctival distress with photophobia, simulating trachoma, and not relieved with the usual trachoma treatment, rapidly cured after the removal of adenoid tissue, the secretions from which irritated the nasal mucous membrane sufficiently to disturb the fifth nerve distribution.

CONGENITAL CATARACT—HEREDITARY INFLUENCES.

Rosa Gantt (*Southern Medical Journal,* March, 1916), writes concerning congenital cataract and the factor of heredity in influencing it. Attention was directed to the study by having found three sisters blind with congenital cataract in one family and a history of a first cousin in the same condition. There was a vague history of cataract in preceding generations. There were eight pairs of twins among the immediate relatives. Reference was made to Loeb's article in 1908 bearing on hereditary blindness. The statement is made that statistics show 58 per cent. of the children of cataractous parents to be cataractous. The Mendelian law is discussed in its relation to the heredity of cataract. If the premise that a cataract is the sequel of an inflammation is correct, other factors enter into the determination

of its transmission. The time at which the cataract appears in the life of an individual causes us to denominate it as congenital, presenile or senile. The question is asked by Gantt, "Why cannot we recognize the truth that they are all dominated by the same hereditary tendency, the same hereditary influence, but different only in point of time, because of the absence of pathological conditions suitable for their development and appearance?" The influence of sex is noted, particularly with reference to color blindness. It is stated that feeble-mindedness, epilepsy and nystagmus are prevalent in those families in which congenital cataract develops. Establish the fact that congenital cataract is hereditary and the proposition follows as an axiom that it is transmitted according to a fixed hereditary law, for the laws of nature are fixed.

METASTATIC ENDOPHTHALMITIS IN A CASE OF CEREBROSPINAL MENINGITIS.

Weakley (*British Med. Jour.,* January 8, 1916) reports a case under the above title which was deemed worthy of record for two reasons: (1) the way the threatened panophthalmitis was aborted and the quick resolution of the inflammation, possibly due to the antimeningococcus serum; (2) the cultivation of a pure growth of meningococcus from the interior of the eye. The disease occurred in a young soldier, suffering with cerebro-spinal meningitis. The spinal fluid was frankly purulent and revealed the meningococcus. The left eye became inflamed a few days after the onset of the disease. Symptoms of a deep seated ocular trouble were present; metastatic infection was diagnosticated. The iris was firmly bound down and did not give way until after paracentesis was done. Hot packs and atropia were used. Cultures of the pus removed from the anterior chamber were made and showed a pure growth of meningococcus. Treatment locally was continued. General treatment consisted of spinal tappings, withdrawing 15-20 ccm. of fluid and replacing with an equal amount of antimeningococcus serum. The media cleared, tension became minus one and vision only P.L. The patient regained his general health, and while the eyeball was saved, usefulness was lost and the eyeball when last observed had begun to shrink.

BOOK REVIEWS.

THE AMERICAN ENCYCLOPEDIA AND DICTIONARY OF OPHTHALMOLOGY. Edited by Casey A. Wood, M.D., C.M., D.C.L.; assisted by a large staff of collaborators. Fully illustrated. Volume VIII. H to Institution for the Blind. Chicago, Cleveland Press, 1916.

This most recent volume of the now well-known American Encyclopedia, like its forerunners, abounds in interesting material.

Among the larger articles we note hemiopia (as the author prefers to call it), heredity in ophthalmology, hypermetropia, injuries of the eye and institutions for the blind. There is, also, a large number of biographical sketches which to some of us may be of particular interest, since it so happens that a number of men are here included whom it has been our good fortune to know personally and whose memory is still bright.

We cannot praise the work of editor and publishers too much.

THE PRINCIPLES AND PRACTICE OF PERIMETRY. By Luther C. Peter, A.M., M.D., F.A.C.S. Illustrated with 119 engravings. Lea & Febiger, Philadelphia and New York, 1916. Price $2.50.

The author of this compendium deserves the thanks of every student of this interesting subject for having given them so clear, concise and yet exhaustive a book on perimetry. The many illustrations, especially of pathological fields, help to grasp the subject more quickly. But, in its handy form, the little book may prove, also, of value to the older practitioner. It deserves a large circulation. ALT.

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ORIGINAL ARTICLES.

TOTAL ABSENCE OF EYEBROWS AND EYELASHES.*

REPORT OF A CASE WITH SOME REMARKS ON ITS ÆTIOLOGY.

By J. F. Shoemaker, M.D.,
ST. LOUIS.

Mr. W., aged 22 years, came to us in May, 1900, complaining that his distant vision was not good and that he had to hold print quite close to his eyes to see to read well. It was found that he had a moderate degree of compound myopic astigmatism in the right eye, and a high degree of mixed astigmatism in the left eye, the correction of which gave him fairly good vision and made him quite comfortable.

In the course of the examination it was noted that there was a complete absence of eyebrows and eyelashes. On questioning him, the following history was obtained: The patient was told by his parents that he had the normal amount of hair on his head as a child until he was six years old when his hair nearly all came out following a severe attack of measles, from which his face and scalp were covered with crusts and his eyes were closed. After recovering from the measles the hair came in over most of his head, but the left front part of the scalp remained bald. Over the other part of the head the hair was thin and fine and never seemed to have much life in it. During the second decade his hair varied, getting thinner at times and at other times thicker. He did not have any eyebrows or eyelashes, however. He developed a few axillary and pubic hairs, but never any to amount to anything. When about eighteen years of age fuzzy hairs grew on his face which always remained of the lanugo type, although he shaved at more or less regular intervals. When

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about twenty-three years of age the hair on his head began coming out in great quantities so that he combed out handfuls. This continued for ten days or two weeks, when he had his scalp shaved, thinking that might help it. The hair never grew on his head again, and that of his face and other parts of his body fell out so that he had scarcely a hair on his body, and practically none have grown since. The patient has been seen a number of times since, the last time only a few days ago, and his condition with regards to hair remains the same. Careful examination at his last visit showed no trace of any eyebrows or eyelashes. There were a few scattered hairs over the scalp, probably eight or ten, half inch to an inch long, and a few more short stumps of hairs which looked as if they might have been shaved off a day or two before. There were also a very few single hairs on his face but none could be seen on his arms, and he stated that there were none in his axillæ or in the pubic region, nor on any other part of his body. He has had no illness since having the measles except an attack of gallstone colic two years ago. Denies venereal infection and the Wassermann test is negative. He was married six months before his hair came out and has had three children. The first, born prematurely at eight months, lived only five weeks. The other two are normal, healthy children, the older one, three and one-half years old, having a fine head of hair; the younger, one and one-half years, not having much hair as yet. The patient appears in perfect health and of normal weight. Has never been sensitive to cold, but on the contrary stands cold remarkably well, but does not stand heat so well. Has always been active. Appetite and digestion are good. No constipation. Sexual appetite normal or above normal. His father, aged 56, is well and has a splendid head of black hair, with very few gray hairs. His mother, aged 53, is well and has good hair. Two brothers and three sisters, living, with normal hair. No family stigmata.

The first question that arises in one's mind concerning his unusual and very interesting condition, is: What causes it? To attempt to answer this question and to study very briefly some of the organs responsible for the condition is the purpose of what follows. The cause evidently is some disturbance of the function of one or more of the ductless glands.

Concerning these glands, Lewellys F. Barker says: "More and more we are forced to realize that the general form and external appearance of the human body depend to a large extent upon the

functioning, during the early development period (and later), of the endocrine glands. Our stature, the kinds of faces we have, the length of our arms and legs, the shape of the pelvis, the color and consistency of our integument, the quantity and regional location of our subcutaneous fat, and amount and distribution of hair on our bodies, the tonicity of our muscles, the sound of the voice and the size of the larynx, the emotions to which our *exterieur* gives expression—all are to a certain extent conditioned by the productivity of our hormonopoietic glands. We are simultaneously, in a sense, the beneficiaries and the victims of the chemical correlations of our endocrine glands."

The endocrine, or ductless glands are the pituitary body, the pineal gland, the thyroid, parathyroid, and thymus glands, the adrenals, the pancreas and the testis and ovary. This hierarchy, so to speak, presides over and controls all the functions of the different organs of the body and metabolism in general. Likewise the glands influence each other, increasing or inhibiting each other's action. To attempt to discuss thoroughly the exact function of each one of these glands is not my intention; indeed it has not yet been fully determined just what purpose each one of them does fulfill, but a few facts that have been fairly well determined may be stated. Of all of these so-called endocrine glands the thyroid seems to be the most important. This may be because it is easiest to study and therefore we have learned more about it and its action. The function of the thyroid seems to be at least two-fold; first, to neutralize certain poisonous substances circulating in the blood, and second, by its internal secretion, to stimulate metabolism by increased oxidation. By noting the symptoms produced where the gland is over-active or where thyroid substance is administered in over-doses we are helped to understand the nature of its action.

Reuben classifies the symptoms of slight hyperthyroidism as follows: (1) hypertrichosis and hyperthermia. (2) acro-erythrosis with cutaneous humidity; (3) emaciation and diarrhœa; (4) restlessness, insomnia; (5) excessive height, developmental precocity, 'syndrome of persistent juvenility'; (6) large, brilliant, protruding eyes with nystagmiform movements, extreme nervous irritability with cardiac and nervous excitability; and (7) hyperthyroidic syndromes, as migraine, ophthalmic migraine, asthma, chronic rheumatism, mucous enteritis, urticaria and certain mental symptoms." On the other hand some of the symptoms of thyroid insufficiency are given by him as: "(1) transitory in-

filtrations of the skin; (2) hirsute derangements, as partial alopecia, capillary nanism, premature baldness and grayness, absence or premature falling out of the eyebrows; (3) caloric disturbances, as coldness of extremities, chilliness, shivering fits, subnormal temperature, chilliness with vasomotor derangements, of which acro-asphyxia, cyanosis and chilblains are the manifestations; (4) anorexia, tendency to obesity and constipation; (5) fatigue and somnolence; (6) small size of patients and retardation of certain developmental processes (dentition, walking, speech); (7) tendency to muscular and articular pains and frontal and occipital headaches, as well as to apathy, indolence and depression; and (8) imperfect development of sexual glands, and diminution of sexual appetite". Thus we see that overaction of the thyroid gland produces an increased growth of hair while underaction of this gland checks the normal growth of hair and causes it to fall out or turn gray, prematurely. It is common knowledge that in myxœdema the hair falls very markedly and what remains is dull and lusterless, and often becomes prematurely gray. Morris refers to a case, reported by Hertoghe, in which entire baldness occurred in myxœdema, followed by complete restoration of hair after the use of thyroid. He also states that in this condition the hair of the scalp often becomes scanty, the pubic and axillary hairs with the eyelashes and eyebrows often fall out and in many cases the teeth become brittle. These signs very frequently disappear under the administration of thyroid preparations. Leopold Levi and H. de Rothschild attach a good deal of importance to the eyebrow sign (signe de sourcil) which consists of a decrease of the number of hairs and sometimes an entire absence of them on the outer third of the eyebrow. This sign is very suggestive of thyroid insufficiency. In this condition the hair of the head very often falls out, but not always. Frequently it becomes lusterless and scanty. It may retain its volume but the hairs become finer and tend to lose their color. While, of course, not all cases of baldness or premature grayness are due to hyperthyroidism, yet no doubt this is the cause in many of the cases. The hair or the beard and mustache may fall, or its growth may be diminished in thyroid insufficiency, while with thyroid excess, spontaneous or due to medication, hair may grow on the face in women, or black hairs may appear in the light colored beards of men.

Probably the testicle comes next to the thyroid gland in its trichogenic importance. There is the one, long-known, genera-

tive part proper of the gonad, or male sex-gland, whose function is to produce the sperm cells. In addition to this there is a second, internal secretory part (the interstitial cells of Leydig) which produce certain substances, or hormones, that influence the development of the genital tract in the embryo, and also bring about the development of the secondary sexual properties of the male, that is, changes characteristic of the male, such as change of the voice and psyche, growth of hair on the face, pubes and axillæ, and growth of the external genitalia. It is also thought that these cells secrete the hormone upon which depends the neural states associated with libido sexualis and potentia coëundi. There may be absence of function of both the generative part and the internal secretory part or of only one of these, the other part remaining active. Examples of the former are cases that have been castrated or where the spermatic cord has been tied. Examples of the latter are cryptorchids and cases where the vas deferens has been tied. In such instances the secondary sexual properties may be normal and libido may be present, but the man is impotent. In eunuchs and eunuchoids the hair on the head may be abundant, but the beard and mustache are absent, although in later life there may be a few scattered hairs as in elderly women. The hair in the axilla is absent and on the mons pubis it is limited to a few short hairs at the root of the penis or, if there be more present, they are limited by a horizontal line, as in the feminine type. There are no hairs on the perineum, trunk or extremities. On the other hand, in cases of pubertas præcox where there is considerable internal secretion of the gonads early in life, hairs grow on the face, axillæ and pubes of young boys as they ordinarily grow only on adults.

Biedl reports a case, described by Sacchi, of a boy who "until he was 5½ years old was physically and mentally normal. At that age his entire being underwent a gradual and progressive change. His bones grew very rapidly, and his muscles became very much developed; the voice became deep; hair appeared at the pubes and upon the face; and his mental condition changed. At 9½ years of age he was 143 centimetres in height, and weighed 44 kg.; he had a long black beard and long hair upon the pubes, chest and legs. The left testicle was enormously enlarged, owing to tumor formation. After removal the tumor was found to be a carcinoma. The pubertic symptoms gradually disappeared and the boy became mentally and physically the same as other boys of the same age." Falta also refers to an-

other case of hypergenitalism, reported by Bernhardt Zichen, a three year old boy in whom an enormous growth began at the eighteenth month. At two years the pubic, axillary and beard hairs were present. At two and one-half years the legs had hair on them, and he looked like a boy of seven or eight. At eight years of age his sexual parts were grown like those of a man and he looked as if he were twenty-five or thirty years of age.

In females there is menstruatio præcox; girls of very tender age, as young as one and one-half to two years of age, have been known to menstruate, with development of the mammæ, growth of hair at the pubes and axillæ and excessive somatic growth occurring. One of such girls was impregnated at eight years of age. Such cases show that there is at least some relation between the growth of hair which usually takes place in certain locations at puberty and the development of the gonads, and no other hypothesis explains the relation so well as that which makes this growth due to the internal secretion of these glands. Furthermore, the progressive physiological diminution of the function of the genital glands is accompanied by senile changes in the cuticle and cuticular glands, in the hair and teeth, as well as in the muscular and nervous systems. Leopold Levi and Rothschild incline to the view that the thyroid chiefly influences the hair of the scalp, and the sexual glands, the pubic and axillary hair, and the beard. The whole subject needs further investigation.

There seems to be considerable evidence to show that the pituitary body, the pineal gland and the adrenals also have something to do with the growth of hair, at least in certain locations. For insance, in acromegalia where there is hyperpituitarism, the hair on the head, trunk and limbs often grows remarkably dense, the individual hair being thick and brittle. On the other hand in Fröhlich's Syndrome—due to hypopituitarism—the skin is very dry, the secretion of the sweat glands is reduced, and trophic disturbances of the hair and nails are common. Morris says that in hyperpituitarism there is marked hypertrichosis while in hypopituitarism, though the scalp hair may be unaffected, except where the gland becomes inactive in adult life, that of the axillæ and pubes may be almost entirely lacking, or in males it may conform to a feminine type of distribution.

McCord states that the following syndrome presents itself due to perversion of pineal function: "First, early sexual maturity, evidenced in the enlarged sex organs, pubic hair, general body

hair, early change in voice; second, precocious mental development, evidenced in maturity of thought and speech; third, general body overgrowth to the extent that a child of five or six years of age may have the appearance of a child of eleven or twelve."

Biedl is authority for the statement that several authors found in boys under seven years of age, abnormal growth in height, abnormal growth of hair, premature development of the genital organs and sexual instinct and mental precocity. Autopsy showed pineal tumors.

Dock quotes Apert as ascribing the syndrome of hirsutism to hyperplasia and tumors of the adrenals. The syndrome is characterized by precocious growth, disturbances in the sexual sphere, obesity and excess and anomalous growth of hair.

Falta also says "that clinical observations demonstrate that from the suprarenal cortex there goes forth an enormous influence on the growth of the body, on the genital sphere and on the hairiness, therefore on an important secondary sexual character". Other observers have found hypertrichosis and premature development in children with hyperplasia and neoplasia of the adrenals, associated with premature ripening of the sex organs. Conversely, they found that atrophy of the adrenals was associated with defective genitalia and hypotrichosis, particularly on the face and pubes. Others have shown that the symptoms found in cases of hyperplasia or neoplasia of the adrenals depend upon the age at which these changes develop. Occurring in children before puberty, the triad—hypertrichosis, adiposity and precocious puberty was found; after puberty, increased hair development, adiposity, and in females arrest of menstruation were noted, while in late cases only adiposity was found.

It is to be noted that the influence on the growth of hair exerted by disturbances of function of the hypophysis, epiphysis, and adrenals is similar to that caused by like changes in the gonads and affects the hair largely in the same locations. It is to be further noted that the secretions from these three glands affect profoundly the internal secretion of the gonads. It seems to me reasonable to suppose, therefore, that the influence that they have upon the growth of hair is probably secondary to their influence upon the cells of Leydig in the testicles; that is they stimulate these interstitial cells of the testicles which, secreting an increased amount of the hormones produced by them, bring about the secondary sexual characteristics and growth of hair

on the face, axillæ and pubes on the one hand; or if this secretion is decreased by the opposite effect from the other glands the hair on these parts does not grow, or if it has already grown is likely to fall out. This leads us to an interesting phase of the subject of the endocrine glands, that is, their interrelation. While this has not been thoroughly worked out as yet, still one fact is fully established, viz., that the physiologic relation of these glands is a most intimate one and that when one of them is diseased or functions abnormally, all the others are likely to be affected. Each one seems to be able to either stimulate or inhibit one or more of the others. While we cannot state positively all the actions the different glands have on each other, probably this much is true:

The hypophysis stimulates the thyroid, the adrenals and the gonads. Inhibits the pancreas.

The thyroid stimulates the adrenals and the gonads Inhibits the hypophysis and pancreas.

The thyroid stimulates the adrenals and the gonads. Inhibits the pancreas.

The pancreas inhibits the thyroid and the adrenals.

The gonads inhibits the hypophysis, the thyroid, the thymus, and the adrenals.

It would seem that our patient has some form of dysendocrinism and that the trouble is due to a diminished secretion of the endocrine glands rather than an increased amount. Just what particular glands are affected it is difficult to say, but judging from the part wich the thyroid and the gonads seem to play in the growth of hair, it is probable that these may be the ones at fault. And yet there are no other marked symptoms of hypothyroidism or hypogonadism. Whether it is possible for these glands to fail to secrete the particular substances that regulate the growth of hair and at the same time furnish the other constituents of their secretions in normal amounts, thus affecting the growth of hair without having any other evidences of faulty secretion, remains to be proved. This hypothesis would at least explain the symptoms in the case reported.

EYE PHÆNOMENA OBSERVED IN THREE HUNDRED AND TWENTY CASES OF PULMONARY TUBERCULOSIS.

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PHILADELPHIA.

REPORT.

I. *Eye conditions which may be directly traceable to tuberculosis.*

Blepharitis marginalis	1
Chronic catarrhal conjunctivitis	1
Engorgement of retinal veins	314
Neuroretinitis (low grade)	34
Papillœdema	1
Phlyctænular scars (old)	3
Retinal haze	17
Uveitis (posterior)	7

II. *Eye phænomena occurring coincidentally with, but not due to tubercular processes.*

Anisocoria	3
Antimetropia	1
Arteriosclerosis	2
Chronic interstitial nephritis (hæmorrhagic)	1
Fuchs' coloboma	3
Lenticular opacities	4
Leukoma of cornea	1
Mucocele	1
Myopia (high)	8
Occlusion of pupil	1
Ophthalmic herpes zoster	1
Paralysis of external rectus	1
Persistent medullary nerve fibers	2
Phthisis bulbi	1
Posterior synechia	1
Primary optic atrophy (tabetic)	1
Pupil irregular	1
Strabismus (convergent)	2
Rotary nystagmus	1

The three hundred and twenty cases which form the basis of this report, were patients who fell under my care for examination in the wards and private rooms of the Rush Hospital for Consumption and Allied Diseases, where it is our custom to make careful ophthalmic examinations of all patients admitted to the house.

The abnormal eye conditions which I found naturally fall under two headings: first, conditions which were the direct or indirect result of the tubercular process; second, abnormal eye phænomena which occurred coincidentally with, but were not caused by tuberculosis. With one or two exceptions, the latter group is not of great importance, possibly the most interesting being the three cases of Fuchs' coloboma.

In the first group, the phænomenon which attracts our attention, and which was present in three hundred and fourteen patients (or in all of the cases in whom fundus details were obtainable) is engorgement of the retinal veins. I do not recall a single instance, when I was able to clearly see the fundus, in which venous engorgement was not present. Few incipient cases of tuberculosis are admitted to the Hospital, as these cases are referred at once to the country branch at Malvern. The cases examined, therefore, were well advanced, and in the majority of instances in the last stage of the disease.

The fundus picture usually observed was a marked overfilling of the veins with dark blood. In some instances, the veins were decidedly tortuous, the disc was blurred, and retinal haze was quite well marked in seventeen cases. This venous engorgement is not the clinical picture of periphlebitis observed in tuberculosis, particularly in the young, known as juvenile vascular disease. It is rather a venous engorgement due to mechanical causes. In thirty-four cases the condition was that of a low grade neuro-retinitis in which the arteries shared in tortuosity and overfilling, and in one case there was papillœdema of about four diopters. The inferior branches of the retinal veins usually were found to be more engorged than the superior branches. The immediate cause of this phænomenon is probably venous stasis, mechanical in origin, while remotely the conditions of malnutrition, and cardiac weakness, from which these patients suffer, are added factors. A third contributing factor is the toxæmia of disturbed metabolism, and possibly in some instances tubercular toxins themselves may be active in the disturbed circulation of choroid and retina. Hæmorrhages were present in but

a single case, and that case was complicated by chronic interstitial nephritis.

The clinical picture is not so characteristic as to be of diagnostic value, as the same phenomenon may be observed in other patients whose vitality has been lowered by months and years of suffering and disease. It is rather an indication of lowered vitality through malnutrition. There is some relation, however, to the stage of the disease. Cases which suffer from repeated hæmorrhages and those approaching dissolution, usually have the evidence in the eyeground marked to a greater degree than the earlier and more robust cases. In passing through the wards, therefore, I found the eye condition fairly indicative of the stage of the disease. The symptom can hardly be regarded as of much diagnostic value because it is a late phænomenon, and the patient's general condition is apparent to even a casual observer. It is, however, a symptom of interest, as it furnishes one with a rather vivid picture of the circulatory conditions existing throughout the body.

A second eye symptom or condition conspicuous especially for its absence, is phylyctænular keratitis and conjunctivitis. No active phlyctænule was observed in a single case examined, and the phlyctænular scars noted in three patients occurred in children. Much has been written pro and con on the relation of phlyctænulosis to tuberculosis, and statistics have been piled up to support both sides of the question, but the whole matter is as yet *sub judice*.

This report is in accord with the generally accepted facts: first, that phylyctænular disease is rarely found in a patient suffering from active tuberculosis, at least of the pulmonary type; second, that it is for the most part a disease of childhood or early adolescence. I can concur fully in the first of these conditions. It is exceedingly rare in adults who suffer from active pulmonary tuberculosis. In childhood, however, I have treated a number of patients in whom phlyctænular conjunctivitis and active pulmonary tuberculosis were present at the same time. It occurs, however, as a rule, in two groups of cases—either in a group which may be regarded as pre-tubercular, or in a post-tubercular group. Medical skill has thus far failed to determine how many children tubercular at birth, or soon thereafter, acquire immunity in early life. Post mortem examinations, however, tend to show that many unsuspected foci of tuberculosis have become healed and immunity has apparently been established, and Roentgenologists

are now definitely locating tubercular areas in lungs of patients thought clinically to be free from the disease. Tuberculosis is so thoroughly disseminated throughout the human family that there is some foundation for the belief, as held by many, that immunity is or is not established in early childhood.

As a forerunner of tuberculosis, and as a post-tubercular condition, phlyctænulosis is a common occurrence. The three cases noted in our report are good examples. A fact more significant, and one which those who believe phlyctænulosis is caused by other conditions than tuberculosis cannot explain, is the rapid and more permanent improvement of the phlyctænule obtained by the use of tuberculin in patients in whom foci of tuberculosis cannot be clinically demonstrated. Tuberculin is selective in its action, and has no beneficial effect in improving the health of an individual not tubercular. These same patients, it is true, are improved by a general tonic and reconstructive line of treatment, but each spring brings with it the usual crop of new phlyctænules, —a condition which obtains more rarely in cases properly treated by tuberculin. In a careful study of these little sufferers, I have therefore concluded as in former reports: first, that phlyctænular kerato-conjunctivitis either is directly traceable to old foci of tuberculosis, or is the forerunner of tuberculosis which will manifest itself in time; second, it is due to a tubercular toxæmia; third, in the rare instances in which it is observed in apparently robust adults, it is an indication that immunity has not been thoroughly established in childhood, and that a fresh outbreak indicates simply lowered general vitality which allows smouldering embers to become sufficiently active to produce a toxæmia without again bursting into really active tuberculosis.

A third interesting fact in this report is the total absence of a tubercle in any part of the uveal tract in all the cases examined. Furthermore, I was not able to find any evidence either in the iris or in the choroid of a possible old scar resulting from a tubercle. This form of ocular tuberculosis is comparatively rare. Vitreous opacities were noted in seven cases, most of which were probably directly related to the tubercular process. This involvement of the choroid, however, was probably due to mechanical causes rather than to direct infection, as venous stasis which is so marked in the retinal circulation undoubtedly must likewise exist in the choroidal circulation.

Dr. S. Solis Cohen, of the Medical Staff of the Hospital, has called attention to the presence of an unusually wide palpebral

fissure in most cases, and requested me to investigate this and also the lagging behind of the upper eyelids when the eyeballs are rotated downward. All advanced cases show an unusually wide palpebral fissure. This is due in part to the absorption of the orbital fat and in part to the relaxed muscle tone of the orbicularis and of the levator palpebrarum. It may be found in any case of emaciation caused by long illness, and is not of special diagnostic value in tuberculosis. For similar reasons, the upper eyelid in many cases, as in exophthalmic goitre, does not follow promptly when the eyeball is rotated downward,—a symptom which is known in ophthalmic goitre as von Graefe's sign. A relaxed orbicular muscle is responsible for this symptom to which Dr. Cohen has called attention.

In the medical literature which has come to my notice, I do not recall any special reference made to the phænomenon of the retinal circulation to which I have called attention in this paper. Such references may have escaped my notice. Vascular disease or periphlebitis, neuro-retinitis due to tubercles of the optic nerve sheath, have been referred to frequently in ophthalmic literature, but they are not the conditions to which I have directed attention in this communication. Because of the presence of this phænomenon in all cases in which fundus details were obtainable, it is worthy of consideration and future study.

Care was observed clinically to exclude other pathologic factors such as lues, diabetes, and chronic nephritis. Complete laboratory tests, however, were not made in each instance for the elimination of lues, but due clinical consideration was given in every case to avoid error. A urinalysis was made in nearly all cases; and in those instances in which more than a venous engorgement existed, special care was observed to exclude chronic Bright's disease and chronic diabetes.

It is interesting also to note that most of the patients examined were young adults, comparatively few being over fifty years of age, and practically the greater number falling between twenty and thirty years. Most of them, therefore, were considerably younger than the usual chronic diabetic and nephritic age.

According to the report, nineteen per cent. of the cases gave evidence of greater involvement than simply venous engorgement,—a percentage sufficiently large to warrant a more careful ophthalmologic study in the future than has been accorded tubercular patients in the usual routine examination.

A deduction which might be made from this report is the rela-

tive infrequency of active tuberculosis of the eye structures. This conclusion, however, is unwarranted. The eye is the seat of tubercular processes more frequently than one would conclude from this report. It is a fact that patients suffering from eye phænomena usually consult an eye surgeon or go to an eye clinic for treatment. In a study of the statistics of eye clinics, therefore, one finds that tuberculosis is responsible for a fair proportion of the inflammatory diseases of the eye; and if phlyctænulosis is regarded as of tubercular origin, as it should be, tubercular disease of the eye would probably lead the list of inflammatory diseases treated.

TEN COMMANDMENTS IN MILITARY SURGERY OF THE EYE.

The following editorial appears in the *Medical Record,* February 26, 1916: "These commandments, or counsels, as promulgated by von Grosz in a recent number of the *Muenchener Medizinische Wochenschrift* (November 16), comprise the protective first aid dressing of the injured eye, to be changed within 24 to 48 hours; the cleansing of the eyelids with 3 per cent. boric acid solution; the application of atropine to dilate the pupil (save when intraocular tension is increased in which case 2 per cent. pilocarpine solution should be substituted); the use of the X-ray and sideroscope when there are symptoms of a foreign body (small entrance wound, intraocular hæmorrhage, traumatic cataract); removal of iron fragments promptly with a magnet and fragments of other kinds by operation; removal of all remnants of eyes without light perception in the interest of the other eye, and the same course in traumatic iridocyclitis without light perception; preservation, in all extirpations, of the conjunctiva and eye-muscles as indispensable in the successful use of an artificial eye; removal of all fragments of projectile in the orbit; repair as soon as possible of all lid defects and ectropions; protection of the other eye in purulent conjuntivitis, which is always infectious.

PROBLEMS PRESENTED BY THE OCULAR PHÆNOMENA OF INTRACRANIAL DISEASE.*

WITH REPORT OF THREE CASES.

By Charles W. Tooker, M.D.,
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The three case histories presented in the following study indicate only a few of the problems that confront an ophthalmologist in dealing with suspected intracranial disease; for it is indeed the ophthalmologist who frequently first encounters evidence of organic brain disease. His certainty of diagnosis and courage in instituting radical treatment, if indicated, often determine the vision, well being, or even life of a patient. It may be pertinent to review very briefly the relations between some brain diseases and the eye.

In the determination of the character of any cerebral symptomology the possibility of syphilis as an ætiological factor is of grave concern. Despite the advances in laboratory methods such an ætiology is frequently impossible to determine. Family and personal histories are of doubtful value, and of late some question has arisen as to the certainty of the blood tests. Uhle (*Jour. A. M. A.*, Vol. 65, No. 10, page 863) states that "under no circumstances should a diagnosis of syphilis be based on the result of the Wassermann reaction alone." As for spinal fluid tests; "The best contraindication to puncture is perhaps the presence of well marked choked disk" (J. B. Ayer, *Arch. Ophth.*, Vol. 45, No. 1). With almost any pathological cerebral condition therefore, the possibility of syphilis lurks in the background.

A most natural division of the types of cerebral disease suggests itself—namely: (1) diffuse diseases of the brain, and (2) focal brain disease. The first case history presented belongs to the focal type of disease, and the last two cases are possibly of the diffuse type. Diffuse diseases of the brain, however, frequently offer confusing symptoms simulating at times true focal lesions, and it is at times very difficult to classify cerebral disease as focal or wide spread.

Focal brain diseases fall into two classes (Swanzy, Oliver and Norris System), first those causing an increase of intracranial pressure, and second, those not causing an increase of intracranial pressure; namely, hæmorrhage and softening. Under the first

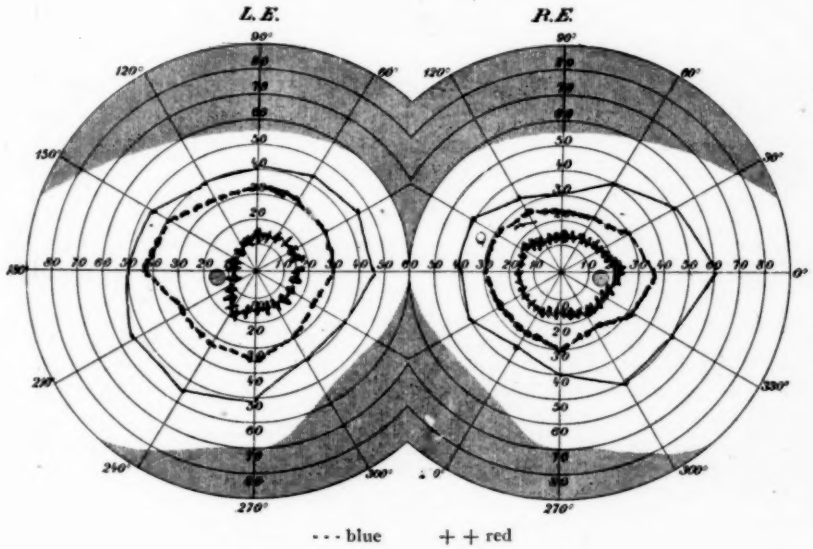
*Read before the St. Louis Ophthalmological Society, March 27, 1916.

class may be grouped tumors, syphilitic or tuberculous growths, aneurisms, cysts, and abscesses. It is especially, in this first class of cases, that problems so frequently arise as to diagnosis and treatment, for all the pathological processes occurring in that class may produce the grave dilemma of papillitis and attacks of temporary total loss of sight. While derangements of vision and derangements of the oculo-motor apparatus caused by various focal brain diseases are of great importance, it is the dramatic appearance of choked disc that excites our interest and apprehension, and also presents the question of operative interference. The pathological process causing focal brain disease may at times be definitely located in the cortex, the optic radiations, the internal capsule, the primary optic ganglia, the optic tract, the optic chiasm, or the intracranial portion of the optic nerve, but the determination of such localization by the ocular manifestations alone is not usually a simple matter. Indeed, serious intracranial trouble may give no symptomatic evidence of its existence for years. Fedor Kraus (*Surg. of Brain and Spinal Chord*, Vol. 7) reported two cases of intracranial tumor of great size lasting for fifteen years and giving no symptoms. One would expect the mental processes to be definitely and characteristically influenced by intracranial growths, but much difference of opinion is expressed in the literature. Alfred Gordon (*Amer. Jour. Med. Sc.*, Vol. 148, page 225), in a recent study of the subject states that "a diagnosis of tumor cannot be based on the presence of certain mental manifestations," and that "concerning mental disturbances in cases of tumor of the brain it is impossible to determine with any degree of accuracy in what particular tumor a certain group of mental manifestations will occur, neither is it possible to draw definite inferences from the seat of the tumor". It is not intended to confuse the case histories here reported by doubts and uncertainties as to the possibility of correct diagnosis and logical therapeutic measures, but to indicate that the management of patients suffering from intracranial disease and showing ocular signs of such trouble may be very difficult.

Case I.—Mrs. S., aged 53, came to our office on June 25th, 1915, with the following history: Fifteen years ago, at the age of 38, she became "cross-eyed"; two months ago she fell down the stairs and has not seen well since. She has sharp pains all over her head day and night and "the top of her head feels as if it were coming off". Dr. W. A. Shoemaker examined her and found choked discs in both eyes, with the following vision: V.

O.D. 18/48 with correction; V. O.S. 18/100, not improved by glasses. There is a paralysis of the external rectus of the left eye. Her vision has remained unchanged during her treatment. The perimetric examination shows a fairly uniform contraction of the form and color fields of both eyes (see chart), with, however, a greater loss of the temporal field in each eye than of the nasal field. There was no reversal of the color fields, regarded by Cushing a few years ago as characteristic of intracranial pressure whether accompanied by choked disc or not. The skiagram showed clearly the absence of the posterior clinoid processes and to the Rœntgenologist seemed characteristic of pituitary tumor formation. Her physician, Dr. Wilson, referred her to Dr. Sauer for examination, who discovered an ethmoiditis for which he operated, giving the patient considerable relief from her headaches after a week. Her vision has not improved, however, and Dr. Shoemaker noted on August 10th that "the discs were somewhat more swollen". The patient stated that she has had occasional attacks of total blindness lasting a few minutes. She lived about two weeks after leaving the hospital, vomited a great deal during the last ten days of her life and complained of severe headaches. Vision remained unchanged to her death.

Mrs. S.



It is quite probable that this case is one of hypophysis disease and so comes under the classification of focal brain disease. The

symptoms do not conform to the classical description of pituitary disease, but irregular forms of the disease must be frequent. The fields of vision, while not typical, are most suggestive, especially when considered with the evidences of increased intracranial pressure. The 6th nerve paralysis is also likewise suggestive. A similar association of 6th nerve paralysis with symptoms of cerebral trouble was recorded in a case of osteosarcoma of the pituitary body reported before this society by the late N. M. Semple (*Amer. Jour. Ophthal.*, Vol. 30, No. 2). The significance of 6th nerve paralysis in cases of suspected cerebral disease has also been emphasized by E. Sachs (*Amer. Jour. Ophthal.*, Vol. 29, No. 12). Fields of vision are not always easy of interpretation. Cushing and Walker (*Brain*, Vol. 37, *et al.*) presented cases of binasal hemianopsia due probably to hypophysis disease. The same case histories and fields seemed to Lancaster to indicate retrobulbar neuritis only (*Boston Med. and Sur. Jour.*, Vol. 168). The age of the patient is not of much significance. Disturbances of the hypophysis evidently occur at all ages. Crigler (*Arch. Ophthal.*, Vol. 44, page 55) reports a tumor of the hypophysis in a boy of 11 years; no operation was performed and he gradually became blind. Choked disc in our case was bilateral. Uhthoff (*U. K. Ophthal. Reports*, 1914) in discussing the surgery of brain tumor states that choked disc was caused by brain tumor in 71 per cent. of his cases, by tuberculosis in 3 per cent. and by syphilis in 12 per cent. In 70 per cent. of his cases of brain tumor the choked disc was ipsolateral. This latter observation is in accord with that made by Horsley. Regarding the diagnosis of hypophysis disturbance, Cushing states that "in every patient suffering from a pituitary disorder there are three clinical factors to be distinguished" (*The Harvey Lecture*, December 10, 1910, and also later): (1) The neighborhood signs and symptoms shown by evidences of pressure on adjoining structures; (2) the general pressure symptoms, in case the growth actually becomes large enough to cause considerable cerebral deformation, or to obstruct the cerebro-spinal fluid circulation by blocking the foramina of Munro; and (3) constitutional or glandular symptoms either on the side of over- or under-hypophysial activity.

It is not surprising that our ideas of treatment are somewhat uncertain in diseases of the hypophysis since such disturbances have been recognized only since Marie described the symptom complex of acromegaly in 1886. It is only within recent years

that scientific knowledge has been applied to this class of diseases, and to brain surgery in general.

One would be somewhat influenced in reasoning by the analogy of thyroid cases that hypophysis disease would yield to medication, but no certainty of results by hypophysis gland medicament is assured. E. Wehrli (*Klin. Mtsbl. f. Augenhlk.*, Vol 62, p. 653; *Amer. Jour. Ophthal.*, Vol. 31, No. 12) has studied a case for three years in which pressure symptoms on the chiasm were pronounced, and the general picture of hyperpituitarism obtained. Only hypophysis gland and a brief course of iodide were employed. The patient's general health was benefited and her weight reduced. Her fields and vision were decidedly improved. He is of the opinion that even after hypophysis operations, glandular treatment should prevail, and perhaps in all cases of pituitarism the treatment by gland substance or extract must continue during the life of the patient. Reber (*New York Med. Jour.*, February 22, 1915) reports a case treated with mixed thyroid and pituitary glands, but the results are not at all conclusive. Schoenborn (*Arch. Augenhlk.*, Vol. 77) stated that organotherapy has generally been without result, and that hypophyseal extracts have given no results.

There has been so much discussion generally regarding radium and Rœntgen exposure that it is quite natural that experiments have been made in pituitary disease. L. Kupferle and A. V. Szily (*Deutsch Med. Wochenschrift*, 41, No. 31; *Jour. A. M. A.*, Vol. 65, p. 985) report a case of cancer of the hypophysis in a man of 65, partially removed through the orbit. Rœntgen exposure preserved his vision for seven months. Beclère has reported 4 cases of hypophysis tumor improved by radium and Gunsett has reported one case. A. Knapp (*Arch. of Ophtal.*, Vol. 44) reports a case of pituitary tumor involving only the optic nerve of the right eye, the skiagram demonstrated the absence of the anterior and posterior clinoid processes of the sphenoid. A sphenoidal operation was of no avail, and he is now experimenting with radium.

Regarding the operative treatment of hypophysis tumors, the results vary considerably with the operator. Some ophthalmologists take rather a gloomy view of the situation. B. Fleicher (*Ophthalmology*, Vol. 11, p. 219), after a study of fifteen cases of hypophysis disease, states that visual disturbances once begun led almost invariably to blindness within a few years. Others favor operation combined with organotherapy. E. Hill (*Arch.*

of Ophthal., Vol. 42, No. 4), in reporting a case of cyst of the hypophysis, remarks that after operation he gave gland feeding (24 grains daily) for a period of 14 months with fairly good results.

Tumors of the hypophysis resemble other brain tumors in that they increase intracranial pressure and destroy nervous tissue by pressure, and it would seem that some uniformity of opinion should prevail as to the indications for operation interference. Indications that are clear to one operator, however, are indefinite to another. E. Von Hippel (*Ophthalmoscope*, V. 12, p. 409), in a review of cases of papillœdema and intracranial disease, concludes that if no operation is performed the prognosis is bad, and that if it be too late for a radical operation, a palliative trephining should be done. At the International Congress of Medicine in London, 1913, (*Lancet*, September 27, 1913, p. 928) Leslie Paton stated that recovery should be expected from mere fluid pressure if the optic nerve, chiasm, or tracts were not directly implicated in the tumor growth. Later if the pressure became that of a solid mass the results were uncertain and there seemed little hope of improving the attendant atrophy. Relief from tumors of the hypophysis can be obtained, according to Cushing, even though this be a growth involving the chiasm by direct solid pressure.

. There are surgeons who have obtained most excellent results by operative treatment and are consequently quite enthusiastic in attacking hypophysis tumors.

In discussing the prognosis of cerebral cases, especially hypophysis tumors, subjected to operation, Cushing states (*Jour. A. M. A.*, January 16, 1915) that the operative mortality in various European clinics has been from 38 to 53 per cent. In his own series he gives the results as 5 per cent. entirely cured, 15 per cent. partially cured and 50 to 60 per cent much benefited; that is alleviation of suffering, preservation of vision and prolongation of life in relative comfort. His method of choice in attacking hypophysis tumors is by the transphenoidal route. The Hirsch operation has been advocated by several operators, and Sewald (*Jour. A. M. A.*, Vol. 65, No. 8) reports a case of hypophysis tumor operated on by that method combined with gland therapy. The result so far has been only a general betterment in the subjective condition. Ball (*Jour. A. M. A.*, Vol. 65, No. 7) reports several cases of intracranial growths—in one a decompression operation gave complete relief from choked discs and headaches. In an-

other a more radical operation removed a cerebral tumor, with recovery and good vision. Another was benefitted by a Cushing operation. These reports were incomplete inasmuch as the final fields and vision were not noted. The decompression operation reported by Bednarski (*Arch. of Ophthal.,* Vol. 44, No. 1) as performed on children are not at all convincing as to favorable results. Another report of a similar operation by Suker (*Annals of Ophthal.,* Vol. 23, p. 580) on a little girl with double choked discs, headaches and transient paralysis of the sixth nerve, records relief from headache and pain, but does not state her vision or the condition of the external rectus after opening the ventricle with a trocar. Judgment is surely difficult in determining the necessity of any surgical procedure when the results will depend so much on the particular specialized skill of the operator. The result "will also always depend on the certainty of diagnosis" (Kuttner, *Jour. A. M. A.,* October 31, 1914).

The patient here discussed died of a probable hypophysis tumor, without an attempt at radical measures. Unfortunately no autopsy was obtained. One must of course remember that a tumor of the brain may be complicated by an hypophysial disturbance. Such a case has been reported by Magruder (*Ophthal. Record,* Vol. 23). A woman, aged 44, suffered from daily headaches for 6 years with frequent losses of consciousness, her blood gave a negative Wassermann reaction and the nasal examination was negative. She had double choked disc and left homonymous hemianopsia. The skiagram was not definite. At autopsy she had a large tumor of the right occipital lobe and a cyst of the hypophysis. Were the indications in our case clear enough to warrant operative measures?

Case II.—Mrs. A., aged 23, attended the eye clinic at the St. Louis Eye, Ear, Nose and Throat Infirmary during the summer of 1914. She gave a history of having contracted syphilis several years ago for which she received a thorough but short course of treatment. At the time of her visits to the infirmary she had a double papillitis of considerable degree, a moderate field contraction, severe headaches, and normal vision. Her blood gave a negative Wassermann reaction, and the rhinologist could find no evidence of accessory sinus inflammation. An experimental sinus operation was refused. After a few weeks' treatment without any improvement, the patient disappeared and could not be traced by the social service department of the clinic. The details of this case are, of course, incomplete. Active anti-luetic treat-

ment did not ameliorate her condition and no cause was demonstrated for the evident increase of intracranial pressure. Should she return later with evidence of atrophy one would recall the remark of Horsley, who maintained "that no case of optic neuritis not due to general infectious disease or toxic causes should be allowed to go on to blindness without an operation." Yet one would hesitate, under such circumstances, to advise radical operative treatment. The management of such cases certainly presents grave problems.

Case III.—Mrs. L., aged 30, came to our office on March 3, 1915, with a history of poor vision, noticed during the last two weeks. There had been a varying amount of headache but no previous eye disturbance. She had had 5 miscarriages, but a blood examination made by Dr. Gradwohl in 1913, 17 months ago, gave a negative Wassermann reaction. She had received no anti-luetic treatment. An examination made by Dr. W. A. Shoemaker revealed a receding neuro-retinitis with somewhat swollen discs in both eyes. In the right eye an atrophic choroidal area was seen in the macular region. Her vision was 13/50 in the right eye and 13/70 in the left eye, not improved with glasses. I took charge of her treatment and for 3 months she received intense mercurial and iodide medication, and two intravenous injections of salvarsan (given by Dr. Mook) with proper intervals of rest. Dr. C. F. Pfingsten reported, after several careful examinations, that he could find no evidence of accessory sinus disease. She developed a nephritis and treatment was modified accordingly. During her treatment and even to the present time there has been no change of her vision. The record of December 15, 1915, shows vision in the right eye 18/100, left eye 18/100, both nerve heads now show evidence of atrophy. The fields of vision have been normal with the exception of a moderate and uniform contraction for colors. On October 27, 1915, three months after mercury and salvarsan had been discontinued, her blood gave a negative Wassermann reaction. (Dr. Tiedemann.) At the present time she can see quite well enough for ordinary purposes and can read much of a newspaper. On February 28, 1916, vision of the right eye =18/70, left eye =18/100. She has had another miscarriage at 6 months, making six in all. No satisfactory diagnosis has been made and the results of her treatment are not encouraging. There is definite evidence of a previous chorioiditis in the right eye but no explanation adequately accounts for her entire ocular condition. There is,

of course, a probability that a luetic infection is present in spite of the negative Wassermann reaction, and it is also possible that her nephritis, while mild and apparently not prejudicial to her general health, may account for her neuro-retinitis. There were, however, no typical exudative star figures in the fundus. The case may or may not be one of intracranial disease. What should one advise in such a case?

It would scarcely be profitable to review all the recent literature relating to intracranial pathological processes. The notations entered in this paper may, however, indicate the principal points of consideration in dealing with grave cerebral disease ominous in respect to vision. If a definite localization of a cerebral tumor, not syphilitic, can be made, it is probably the concensus of opinion to attempt removal by surgical procedure. Disturbances of the hypophysis cerebri that are dangerous to visual tissue either by pressure or by displacement, are also best managed by surgical means. Not much credence is placed generally in medical treatment, or in treatment by Rœntgen rays or by radium. A very large group of cases remains in which decision is most difficult; symptoms of cerebral pressure are not definite perhaps, or if definite do not seem to localize the pathological process.

It is to be hoped that we may soon agree on the indications for surgical interferences and so reduce the size of this large class of indefinite cases. It is also most desirable that there be surgeons of special skill in cranial surgery in whom one can place confidence, both as to judgment and execution.

In conclusion, this short and incomplete study of a most interesting phase of ophthalmic practice may indicate the necessity of the collaboration of the ophthalmologist and the special surgeon of the nervous system in the management of intracranial disease with ocular manifestations. It may also serve to indicate the need of much experimental work in surgery of the brain and a greater dissemination of the knowledge thus obtained, so that it may be available at any time, and in any city. Cranial surgery should become as definite in execution and in prognosis as is abdominal surgery. The ophthalmologist will then have fewer problems presented to him that cannot be justly solved.

MEDICAL SOCIETIES.

THE POLYCLINIC OPHTHALMIC SOCIETY,

PHILADELPHIA, PA.

Stated Meeting, January 13, 1916.

Dr. William Zentmayer, Chairman.

Subject: SYMPOSIUM ON "THE OCULAR CHANGES DUE TO BRAIN TUMORS."

"The Neuropathology of Choked Disc."—Dr. John H. W. Rhein (by invitation).

In discussing the neuropathology of optic nerve changes in brain tumor, it will be necessary to briefly refer to the mechanism of the production of choked disc or papillitis. Several theories have been advanced to explain this, of which it will be necessary to refer only to the backwater theory of von Graefe, the inflammatory or toxic theory, and the mechanical or lymph space theory.

The backwater theory of von Graefe explains the choked disc as being due to a venous stasis occasioned by the obstruction to the return of venous blood from the cavernous sinus, but this theory is not tenable since Sesamann demonstrated the anastomosis between the ophthalmic and the anterior facial veins.

The inflammatory or toxic theory as advanced by Leber and Deutschmann claims that choked disc is not merely a stasis, but an inflammatory condition due to an irritation set up by the presence of a toxic fluid, this fluid becoming infected by reason of the intracranial disease or the lesion primarily causing the trouble. Deutschmann contends that it is due to a pathogenic micro-organism. On the contrary, Duret did not see any action of microbes in the causation of papillœdema.

Uhthoff, basing his theory on a study of 800 cases in literature and on his own experience, did not believe that the theory that choked disc was a primary inflammatory process was tenable, nor that it had ever been successfully demonstrated that toxins of micro-organisms were the cause of choked disc, the rare presence of choked disc in meningitis speaking against this theory. Inflammatory appearances, he concluded, were of a secondary nature. They were not always present in early cases. Bergmeister, Cushing, Spiller, Schieck and others have disproved the

presence of inflammatory changes in the early stages. On the other hand, Liebrecht found an inflammatory process in the neurolemma and Elschnig found inflammatory appearance in all his cases. He later stained his specimens by the Marchi method. Von Hippel, on the other hand, studied two cases by the Marchi method and found no inflammatory changes. Wilbrand and Saenger found that the inflammatory change was very insignificant and only was there an increase in the nuclei.

The theory which is generally accepted is the mechanical theory of Schmidt-Rimpler which is explained on a basis of increased intracranial pressure, which forces an increased amount of subarchnoid fluid into the intervaginal spaces of the optic nerve or into the lymph spaces, causing œdema, congestion and lateral inflammation. This theory is supported by the experiments of Merz and those of Cushing and Bordley. According to Paton, Gordon, Holmes and Schieck, lymph stasis is the cause of choked disc. Schieck found primarily the lymph spaces in choked disc extensively distended, and he observed œdema, swelling of the papilla, swelling of the nerve fibres, and secondarily, a reactive inflammatory appearance with proliferation of the connective tissue and of the glia. Later the same observation expressed the view that papillœdema was caused by the entrance of cerebrospinal fluid into the preformed perivascular lymph spaces of the axial bundle of the optic nerve and along the central vessels into the disk.

The cause is the excessive pressure of the fluid, or intracranial pressure. Local stasis in the intravaginal space of the optic nerve, persistent decrease of the intraocular tension and collapse of the vessels of the axial bundle after profuse hæmorrhage, were also factors. In a microscopic study of eight eyes he did not find any sign of inflammation. The perivascular lymph spaces in the central bundle were not closed, but were in open communication with the intervaginal spaces. The lymph space was extensively distended. Marked distension of the perivascular spaces around the branches of the central vessels, was characteristic. The filling of the lymph spaces was due to a flux of fluid into the lymph spaces in the peripheral direction and occurs at the lamina cribrosa, and owing to the counter pressure of the vitreous the fluid fills the perivascular spaces of the retinal vessels giving rise to an appearance of œdema. He experimented upon monkeys, producing increase in intracranial pressure, and believed that this experimental work shows that the papillœdema

was due to the quantity of fluid and pressure rather than to the quality of the fluid, and that the latter was not inflammatory.

The neuropathology of the choked disc can be summed up as follows. There is simple œdema of the nerve stem, chiefly around central vessels, and hæmorrhage into the nerve. The intervaginal space is distended, and this is the seat of capillary hæmorrhages and effusions, and also lymph and endothelial proliferation. The lamina cribrosa is humped and there is distention of the lymph spaces. The inflammatory cases show perineuritic changes. Varicosites, fanshape appearances, hypertrophy and swelling of the nerve fibres have been described. Perivascular round cell infiltration is present in inflammatory cases, and bloodvessel changes consisting of thickened wall, occlusion of the lumen, and infiltration of the adventitia. The glia is proliferated and the connective tissue of the septa is thickened and infiltrated. The myelin sheaths present changes and there is atrophy of the nerve fibres, similar to changes found in the spinal cord following pressure. Experimentally, the nerve becomes œdematous, the lamina cribrosa is distended by the œdema, the papilla is pushed forward, the vessels become swollen, the vaginal space distended, and there is hæmorrhage into the vaginal space, and in one case infiltration.

Dr. Charles R. Heed reviewed the classical picture of choked disc or papillœdema, and exhibited several paintings illustrating the ophthalmoscopic changes found in cases affected with brain tumor. A summary of other affections such as sinus disease, nephritis, grave anæmias, serious intoxications, many of the acute infections, etc., producing changes simulating choked disc were discussed. The ophthalmoscope was lauded as the most valuable single aid in arriving at a diagnosis of brain tumors.

Dr. Walter W. Watson spoke on the disturbances of the ocular muscles in tumors of the brain. He said that intracranial disease as a menace to the integrity of the ocular muscles had been known for many years but only in a vague way until von Graefe in 1854 first called attention to the appearance of the intraocular end of the optic nerve in many cases of brain tumor, when a new impetus was given to the study of the ocular muscles from like causes.

While symptoms due to pressure upon the nerves supplying the ocular muscles in their course from the base of the brain are so frequent as to be quite familiar to all clinicians, symptoms following brain lesions due to tumors and degenerating areas in or

near the cortical centres of these nerves are rather rare and therefore not well known.

Brain tumors may affect the nerve centers in the cortex of the brain known as the higher centers, or the nerve nuclei in the floor of the 4th ventricle, when it is known as nuclear paralysis, or the lesion may be in the root fibres as they emanate from the nucleus and coalesce to form the nerve trunk just before leaving the brain, when it is specialized as fascicular paralysis. Tumors that affect the connections of the nuclei of the nerves with the cortex, Dr. Watson pointed out, do not in general cause paralysis of the individual muscles of the eye, but may in these situations affect the co-ordinate ocular movements; that is, convergence, divergence, and parallel movements. According to Willbrand there is an exception, ptosis.

The theory was supported that convergence and divergence are reflex phænomena with a possible centre in the cortex or optic thalamus, by quoting cases of cortical lesions from tumors in which there was paralysis of voluntary ocular motion with a preservation of reflex or automatic movements. Yet it is undoubtedly true that losses of movements of convergence and divergence are probably brought about from lesions involving the tracts in the pons and cerebral peduncles.

Tumors of the cerebellum may give rise to an inability of both eyes to travel to the right or left more than the median line, the eyes turning away from the side of the lesion. Small tumors of the pons involving the abducens nucleus are likely to cause paralysis of later eversion without a paralysis of convergence, the abducens affected being on the opposite side to that of the hemiplegia, a point for differential diagnosis with cerebral tumors where the abducens involved is on the same side. In summing up he said that in the majority of cases where a tumor involving the pons is associated with paralysis of ocular movements, either convergence or divergence is lost.

Attention was given to the fact that while paresis or paralysis of the 6th nerve may be strictly of localizing value, on the other hand it may be an indirect symptom of a tumor of large size in various regions of the brain and that a tumor to cause a simple paralysis of the sixth must be so situated as to cut off the emergent root fibres, that is, be a fascicular paralysis.

Function of the third nerve was interfered with in tumors involving the nerve nuclei, the corpora quadrigemina, or the gray matter about the aqueduct of Sylvius, though complete paralysis may be produced by tumors involving the frontal or temporal

lobes or the peduncle. Tumors of the pituitary body may produce symptoms indicative of involvement of the third, fourth or sixth nerve.

The pupillary reflex arc is disturbed, according to Casper, when the lesion is near the sphincter nucleus, or, as in Mocli's case, from a tumor involving both sides of the third ventricle. Anisocoria and hippus may be present in tumors involving the sphincter nuclei of the third nerve; and in the production of the Argyll-Robertson pupil Uhthoff places the lesion between the external geniculate bodies and the sphincter nucleus.

Lastly, Dr. Watson referred to nystagmus as being present with almost all cerebellar tumors, and in tumors of the quadrigeminal or frontal lobles it may be one of the chief symptoms.

"Changes in the Field of Vision in Brain Tumor."—Dr. Wm. Zentmayer.

One of the early and not infrequent disturbances of the field of vision in brain tumor is recurring temporary obscuration of the entire field, that is, blindness. Such attacks may be uni- or bilateral. The frequency of their occurrence varies from several attacks daily to perhaps a single occurrence. They are probably due to vaso-motor disturbance or possibly arise from tumor toxœmia.

Visual phænomena, such as phosphenes, scintillating scotomata or hallucinations, occur and when in association with hemianopsia usually occupy the dark field. They are not of localizing value although perhaps more common when the visual memory in the occipital region is affected.

Aside from field defects of a symmetrical nature, disturbances of the visual field in brain tumor are those resulting from the local effect of the papillœdema or optic atrophy. Perhaps the most constant change is that of enlargement of the blind spot. The peripheral defects vary, being influenced by the degree and character of the swelling. Thus a uniform swelling would produce a concentric contraction whereas a more unequal swelling would produce irregular contraction with possible recentering angles. Interlacing of the color fields is probably of less diagnostic importance than was for a time believed. Some have explained binasal hemianopsia in this way. When the growth is so located as to produce pressure upon the visual tracts, either directly or indirectly, hemianopsia results. Lesions in the anterior or posterior crotch of the chiasm may produce bitemporal hemianopsia. In hypophyseal disease the development of the

hemianopsia is usually gradual. Often the first indication is a slant to the upper outer limits of the field and this is usually manifested first in the color field. Even after a true hemianopsia has developed it may for some time be only a hemiachromatopsia. If you recall the arrangement of the fibres at the chiasm it will be clear to you why the hemianopsia produced by tumors at this position is apt to have very irregular dividing lines between the seeing and blind areas, often instead of a true hemianopsia we have only symmetrical defects. And it must not be forgotten that homonymous lateral hemianopsia is at least half as frequent as bilateral. A characteristic of hemianopsia due to pituitary disease is the variability of the defect from day to day as it were, and the occasional spontaneous or post-operative recovery even after the lapse of years, showing that the defect had been due to a physiological blocking of visual impressions and not to destructive changes. The possible occurrence of central or symmetrical paracentral scotomata as an initial finding in pituitary disease must not be forgotten.

A growth pressing upon either the dorsal or ventral surface of the chiasm can produce either a superior or inferior hemianopsia. Binasal hemianopsia due to tumor must be of extreme scarcity as it requires a double lesion to produce it, such as could result from atheroma of cerebral vessels.

In lesions behind the chiasm, the dividing line between the seeing and the blind areas of the field is usually a vertical one, commonly with preservation of the fixing point in the seeing area. There are exceptions, however, as in basal lesions occasionally the dividing line is irregular. The significance of hemiachromatopsia in lesions behind the primary centers is in dispute, some hold it to be the result of a cortical lesion of less intensity than where the loss of vision is complete. Altitudinal hemianopsia can be produced by lesions of the calcarine area. It is probably that the lesion is a homolateral one. A double homonymous hemianopsia may result from a growth invading both hemispheres.

It is obvious from what has been said that hemianopsia of the homonymous type is of little localizing value in itself, but in association with other symptoms such as disturbances of papillary reactions, oculomotor and other cranial nerve palsies, speech defects, fundus changes, hemiplegia and hemianæsthesia, etc., its presence assists in localization.

WALTER W. WATSON, Secretary.

ABSTRACTS FROM MEDICAL LITERATURE.

By W. F. Hardy, M.D.,
St. Louis, Mo.

A CASE OF RIGHT ABDUCENS PARALYSIS FOLLOWING ACUTE MASTOIDITIS.—GRADENIGO'S SYNDROME.

Myers (*Annals of Otology, Rhinology and Pharyngology,* December, 1915) gives a case report in full and appends brief notes of three other cases seen by Dr. John Dunn. His case was a typical example of that group of symptoms and functional disturbances which are known to us as Gardenigo's Syndrome. The chief manifestations are, purulent discharge from the ear, abducens paralysis, neuralgia, pain over the frontal and parietal regions. Harold Hays collected reports of ninety-five cases from the literature. The case of Myers was particularly interesting, as the signs and symptoms were indicative of a grave condition —pain over the right side of the head, nausea and vomiting for six days, purulent discharge from the canal, temperature from 100 degrees to 105 degrees, slight traces of albumin in the urine, slight papillitis in right eye and diplopia developing six days previous. Mastoidectomy was performed on account of the sixth nerve paralysis, high temperature and peculiar symptoms. There was no mastoid tenderness. The following day diplopia was a well marked nystagmus on rotation of eye to the left. Perkins, quoting from Hays' article, remarked that intense headache, especially in frontal region, severe pain in eye or deep in orbit, neuralgia of the fifth nerve or paralysis of some of the muscles supplied by it, are symptoms, one or more of which have been noticed in fifty-five out of the ninety-five cases reported. This indicates that there is some interference with the Gasserian ganglion by the process going on at the apex of the petrous bone. The ætiology of Gradenigo's syndrome is obscure. The general ætiology of acute acquired paralysis of the ocular muscles is known to be either intoxication, infection or traumatism. Meyers inclines to the belief that intoxication or toxæmia is the underlying cause of these cases, together with traumatism when the mastoid is sclerotic. Just why the fifth and sixth nerves should be the only ones affected is to Myers obscure. Gradenigo's conclusion is that from some cause a circumscribed leptomeningitis is produced at the tip of the petrous bone. Lubet Berbon object to this and

believe its origin to be reflex. Many authors think that sinus involvement or intracranial lesion of some kind exists. It has been observed following grippe. Myers concludes by stating that the advent of these symptoms into a case one has operated upon for what appears to be an ordinary one of simple mastoiditis must necessarily be somewhat alarming and calls for a wider study and discussion of the subject.

THE AMERICAN METHOD OF CATARACT EXTRACTION.

An article by Santos Fernandez (*Medical Record,* March 18, 1916) leaves the reviewer in a quandary as to the thought the author desires to convey. That there exists a distinct "American Method" is news and a matter of surprise. Reference is repeatedly made to De Graefe, meaning no doubt von Graefe. Santos Fernandez looks upon the combined extraction with a conjunctival flap as the American method, and regards it as more complicated because of the iridectomy performed. It is to be regretted that all of us have not been as fortunate in our observations as the author, who states that in the operation as practiced in America he has never seen the escape of vitreus because "this is an accident that the American surgeons take great care to avoid." The combined extraction is designated as slower and requiring greater skill on the part of the surgeon. The statement that the roundness of the pupil is only slightly affected is contrary to the experience of most of us. The great advantages seen by the author in combined extraction are the lessening of the danger of iris prolapse, the absence of post-operative rise of tension due to swelling cortical remains, and the rapid absorption of cortex left behind.

Regarding cataract operations in general the following conclusions are reached: (1) Although cataract operation has reached a high degree of perfection, it has slight inconveniences that often give rise to the fear of an unfavorable result following even the most skillful operation. The fear of complications, however, may be dismissed when to the combined extraction operation is added the formation of a conjunctival flap. (2) In any case of old senile cataract with no cortical material, simple extraction is enough if a conjunctival flap is also made. (3) Suture of the cornea in cataract extraction may be resorted to by those surgeons who are accustomed to it in cases in which they consider it necessary.

EYE ADENOIDS AND THEIR RELATION TO THROAT ADENOIDS.

Oertel (*Annals of Otology, Rhinology and Laryngology,* December, 1915) reviews the anatomy of the conjunctiva and of the throat with particular reference to adenoid formations. To the statement that follicular conjunctivitis occurs without inflammatory manifestations the author takes exception. The follicles consist of circumscribed aggregations of lymphocytes (adenoid tissue) identical in structure with the granulations of trachoma. It is held that the pathology of the lymph nodes of the eye do not differ essentially from the lymph nodes elsewhere. The changes are cellular, and size, therefore, has no bearing on the point at issue. It seems rational to the author to conclude that follicular conjunctivitis is always inflammatory. The causes set down as provocative of pharyngeal hyperplasia are legion. It is not proper to presume that adenoids will group themselves alone into one distinct mass in the vault of the pharynx. The author mentions the frequent occurrence of innumerable lymphoid hypertrophies not only in the vault but over the whole surface of the oropharynx. The theory of a common infection of the lymphatic tissues of the eye and throat conveyed through the lymph vessels may not be incorrect. It would seem to be reasonably certain that whatever the ætiology, there does exist a uniform relation between eye adenoids and pharyngeal adenoids. The statement, commonly made, that all cases of follicular conjunctivitis recover and leave a normal mucous membrane is far from correct. Oertel examined a large number of school children in gaining material for his thesis. A total of 818 children were examined. Those with follicular conjunctivitis numbered 127. Those with follicular conjunctivitis having distinct enlargement of pharyngeal lymphatics to a pathologic degree numbered 127. In all but two of the cases there was also marked hypertrophy of the faucial tonsils. One case had undergone tonsillectomy and adenectomy a year previous. At the time of writing the pharynx was again filled with adenoids and there was a severe grade of follicular conjunctivitis. The conclusion is reached that eye adenoids (follicular conjunctivitis) indicate the existence of throat adenoids.